Bald Eagle Restoration on the Northern Channel Islands, California

January — December 2005

4th Annual Report

MONTROSE SETTLEMENTS RESTORATION PROGRAM

MSRP

Restoring Natural Resources
harmed by DDTs and PCBs

Bald Eagle Restoration on the Northern Channel Islands, California
January — December 2005
4th Annual Report

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EXECUTIVE SUMMARY

Bald eagles (*Haliaeetus leucocephalus*) once nested on all the California Channel Islands off the coast of southern California, but disappeared by the early 1960's. Human persecution contributed to the population decline, but the introduction of DDT into the Southern California Bight, starting in the late 1940s, is thought to have led to their ultimate extirpation from Southern California.

In 2002, the Institute for Wildlife Studies (IWS) initiated a 5-year bald eagle restoration feasibility study on Santa Cruz Island, under contract with the National Park Service. Since that time, 46 eagles have been released on the island. The birds have been released using a technique called "hacking" and the population has been intensively monitored to determine how well they have adapted to the new environment and whether they are accumulating body burdens of organochlorine contaminants that could prohibit successful breeding.

IWS released 12 eagles from hacking towers in 2005, bringing the total number of birds released since 2002 to 46. These eagles were acquired from captive-breeding eagles at the San Francisco Zoo (11 birds) or wild nests in Alaska (1 bird that recovered from avian pox). Each bird was equipped with a GPS/VHF telemetry package to allow post-release monitoring. Two of this year's released eagles died. One died in September when it got stuck in a flume at a fish hatchery in Washington and the Alaskan bird died of unknown causes on Santa Cruz Island in November. In addition, a bird was recovered alive on Santa Rosa Island with lead poisoning and a broken wing. That bird was taken to the Orange County Birds of Prey Center for treatment and is expected to fully recover.

As of the end of December 2005, 31 of the 46 bald eagles released are still on the northern Channel Islands (seven from 2002, six from 2003, 11 from 2004, seven from 2005). One bird released in 2005 is alive in Washington. Two other birds released on Santa Cruz in 2003, which have lost their transmitters, were on the mainland during 2005. In addition to the birds released on Santa Cruz, three eagles previously released on Santa Catalina Island are now on Santa Cruz Island and there have been several sightings of unmarked bald eagles on the northern Channel Islands.

Bald eagles on Santa Cruz Island have been observed feeding primarily on feral pig carcasses, although they occasionally have been seen feeding upon marine mammal carcasses in

the Chinese Harbor area. Bald eagles have continued to use Santa Rosa Island, especially during the fall through spring, where they have been seen feeding on carcasses and gut piles of mule deer (*Odocoileus hemionus*) and Roosevelt elk (*Cervus canadensis*) left from the guided hunts and culling activities, and on marine mammal carcasses on the beaches.

It is unknown whether bald eagles on the northern Channel Islands will ingest enough DDT-contaminated food to affect their breeding in the future. In 2005, IWS trapped two eagles released in 2002 and collected blood for contaminants analyses. We also have continued collection of potential food items to evaluate DDE contamination.

The high survival and retention rates of released bald eagles on the northern Channel Islands are reason for optimism regarding the success of the program. The continued movement of eagles among the islands indicates that the releases on Santa Cruz Island are likely to restore bald eagles to two or more of the northern Channel Islands. Additionally, the sightings of unmarked bald eagles and eagles from Catalina indicate that other eagles are being attracted to the islands, further increasing the population of bald eagles on the northern Channel Islands.

ACKNOWLEDGMENTS

IWS thanks the National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), California Department of Fish and Game, National Oceanic and Atmospheric Administration (NOAA), The Nature Conservancy, U.S. Navy, Alaska Department of Fish and Game, U.S. Forest Service, and the Avian Conservation Center (ACC) at the San Francisco Zoo. Funding for the project was made available by the Montrose Settlements Restoration Program.

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INTRODUCTION

Bald eagles (*Haliaeetus leucocephalus*) were once common residents on the Northern Channel Islands off the coast of Southern California (Fig. 1). A minimum of five pairs nested on Santa Cruz Island, three pairs on Santa Rosa Island, three pairs on San Miguel Island, and three pairs on Anacapa Island in the early 1900's (Kiff 1980, 2000), but they disappeared by the 1960's.

Figure 1. The California Channel Islands off the coast of southern California.

Bald eagle numbers began declining on the Channel Islands in the late 19th Century, largely due to human persecution, but the ultimate cause of bald eagle extirpation from the Channel Islands was likely the introduction of the organochlorine pesticide DDT into the Southern California Bight. DDE (a metabolite of DDT) levels have been found to be inversely correlated with eggshell thickness and productivity in bald eagles (Hickey and Anderson 1968, Wiemeyer et al. 1984). DDE levels of 3-5 ppm wet weight in bald eagle eggs have been associated with reduced productivity, with reproductive failure approaching 100% with DDE levels of >15 ppm (Wiemeyer et al. 1984). The last confirmed successful nesting of bald eagles on the Channel

Islands was on Anacapa Island in 1949 (Kiff 1980). The decline in bald eagle populations in southern California was concurrent with declines in seabird breeding success in the Southern California Bight and with continent-wide declines in bald eagle populations, much of which was also attributed to the impacts of DDT (Risebrough et al. 1971, Anderson et al. 1975, Grier 1982, Wiemeyer et al. 1984).

Efforts to restore bald eagles on the California Channel Islands began in 1980 when the Institute for Wildlife Studies (IWS), in cooperation with the United States Fish and Wildlife Service (FWS), initiated a program to reintroduce bald eagles to Santa Catalina Island, CA (Fig. 1). Between 1980 and 1986, 33 eagles were released on the island from three different artificial nest or "hacking" platforms (Garcelon 1988). Many of these birds matured and formed breeding pairs on the island, but all the eggs produced broke in the nest. Concentrations of DDE in the remains of eggs removed from failed nests implicated this contaminant as the causal agent of the lack of productivity (Garcelon et al. 1989). Eggs removed from nests on Santa Catalina Island exhibited little thinning of the shell, but exhibited areas of gross structural abnormalities of the eggshell that resulted in rapid water loss and a weakening of the eggshell (Risebrough 1998). Mean levels of DDE in egg remains removed from nests in 1987 and 1988 were twice as high as that which has been shown to cause complete reproductive failure (Wiemeyer et al. 1984), indicating that there was still a large amount of DDE in the food chain.

The probable source of the DDE was discovered around 1970. The Montrose Chemical Corporation, which was once the largest DDT manufacturer in the world, is believed to have dumped DDT from their Torrance, California facility through the sewer systems emptying into the ocean at White's Point on the Palos Verdes Peninsula from 1947 to the early 1970s. In 1990, the U.S. Department of Justice and the California Attorney General filed a lawsuit against this company, alleging that they were responsible for releasing DDT and other hazardous chemicals into the environment. In December 2000 a settlement was reached that provided $30 million for natural resource restoration in the Southern California Bight, including bald eagles (Department of Justice press release, 12/19/00).

The Montrose Settlements Restoration Program was developed to oversee the settlement monies set aside for natural resource restoration. The Trustee Council that oversees the program is composed of representatives of Federal and State agencies that have interests in the Southern California Bight, including the National Oceanic and Atmospheric Administration (NOAA),

United States Fish and Wildlife Service (FWS), National Park Service (NPS), California Department of Fish and Game, California State Lands Commission, and the California Department of Parks and Recreation.

In April 2002, the Trustee Council approved funding to begin an experimental reintroduction of bald eagles to the northern Channel Islands, which are further from the pollution source and could have low enough levels of contaminates in the food chain to allow successful reproduction by bald eagles. The project and funding was administered through the National Park Service, Channel Islands National Park, who contracted with IWS to begin a 5-year experimental reintroduction. The project called for IWS to release 12 bald eagles per year on Santa Cruz Island and then carefully monitor the population to determine how well they adapted to the new environment and whether they accumulated body burdens of organochlorine contaminants that would prohibit successful breeding. Reintroduction through hacking has been a successful tool in reestablishing bald eagles and other raptor species into formerly occupied habitat (Newton 1988, Nye 1988, Cade 2000) and IWS has already reintroduced bald eagles as a nesting population on Santa Catalina Island, showing that the technique could be successful on the Channel Islands (Garcelon 1988).

This report summarizes the fourth season of releases and monitoring conducted from January through December 2005.

STUDY AREA

Santa Cruz Island is located approximately 20 miles off the coast of Ventura and Santa Barbara counties. Santa Cruz Island is the largest of the eight California Channel Islands, measuring about 38 km in length and 12 km wide at its widest point (Fig. 2). The land area is approximately 249 km^2 with 124 km of shoreline and a maximum elevation of 753 m. Santa Cruz Island is the most rugged and topographically diverse of the Northern Channel Islands and has a Mediterranean climate, with mean monthly temperatures ranging from 11.7 - 20.9° C and a mean annual rainfall of 50 cm (Junak et al. 1995). The NPS owns and manages the eastern 24% of the island and The Nature Conservancy (TNC) owns and manages the western 76% of the island.

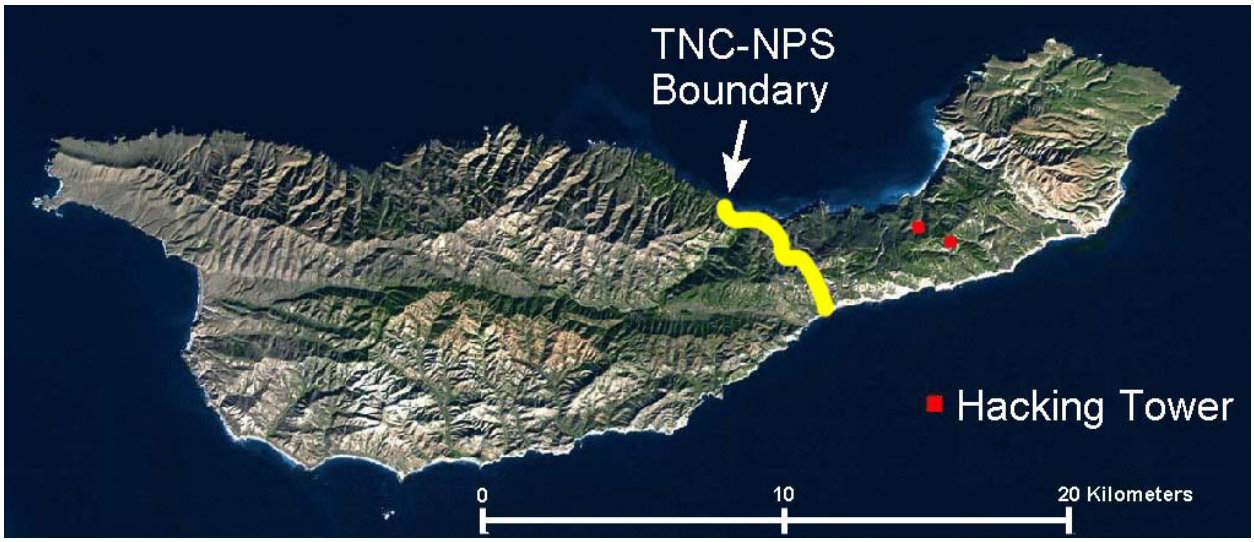

Figure 2. Santa Cruz Island, California with the boundary between The Nature Conservancy (TNC) and National Park Service (NPS) properties.

METHODS

Permitting

IWS has the required Federal Fish and Wildlife Permit (Permit TE744878-8) and a Memorandum of Understanding with the CDF&G to conduct the bald eagle restoration feasibility study on the northern Channel Islands. IWS has a banding permit from the United States Geological Survey's Bird Banding Laboratory allowing banding and radio-tagging the eaglets prior to release and a Letter of Authorization from NOAA that allows collecting and possessing biological samples from dead marine mammals for contaminant and stable isotope analyses.

Bald Eagle Acquisition

In 2005, 11 of the 12 young bald eagles were acquired from the Avian Conservation Center (ACC) at the San Francisco Zoo, CA. The twelfth eagle was removed from a nest near Juneau, Alaska in 2004 and kept in captivity until 2005 because it had a severe case of avian pox.

Bald Eagle Hacking

The eagles were placed in one of two hacking towers (North or South Tower) upon arrival on Santa Cruz Island (Fig. 2). Two to four birds were placed in each cage and fed fish and feral pig (*Sus scrofa*) until their release. Each cage was monitored remotely using a wireless video system to ensure that each bird was eating and healthy. We also kept daily records of how much food was placed in and removed from each cage, as well as of the general behavior and appearance of each bird.

When they were approximately 11 weeks old, we fitted each bird with a combination satellite/VHF transmitter (Fig. 3), patagial wing markers, and Fish and Wildlife Service leg band. The satellite transmitters record GPS locations of the bird and then upload them to a satellite approximately every three days. This would allow us to relocate birds that we were unable to find using traditional VHF telemetry. We also collected ~10 cc of blood from each bird for baseline contaminant analyses.

Figure 3. PTT GPS unit with VHF transmitter (gray) attached to the side. The whole unit weighs approximately 100 g.

When the birds were approximately 12 weeks old, we opened the release doors on each cage. It took up to two weeks for the birds to fledge from the towers. We continued to place food items in and around the towers to provide a known food source for the birds while they developed their flight/scavenging skills.

Post-Release Monitoring

Following the release of the eagles we closely monitored each bird to ensure that they were finding food and healthy. We usually were able to locate the birds for visual monitoring using a VHF telemetry receiver (Model R1000, Communications Specialists, Inc., Orange, California). Eagles that we were unable to locate using VHF telemetry could usually be relocated using the GPS data that we retrieved via computer from Argos, Inc. (Largo, Maryland) satellites. We attempted to locate each bird at least 2-3 times per week. We also placed Cuddeback digital trail

cameras at carcasses to assist us in identifying feeding birds and help verify that individuals were finding food.

Beach Watch Surveys

To gain a better understanding of the potential contamination that bald eagles might acquire by feeding on beached animals, IWS biologists conducted monthly surveys of seven beaches on Santa Cruz: Chinese Harbor, Prisoner's Harbor, Laguna Beach, Johnson's Beach, Pozo Beach, Sauces Beach, and Christy Beach (Fig. 4). Beaches were monitored at low tide to maximize likelihood of finding beached organisms. Data were collected by walking the beaches and

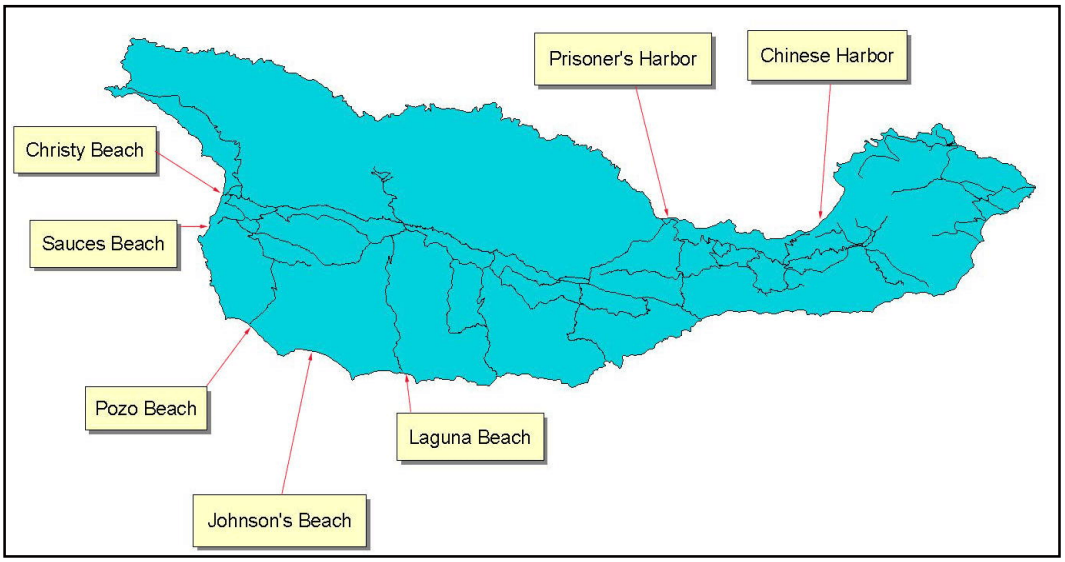

Figure 4. Locations of beaches on Santa Cruz Island, California where monthly surveys were conducted for beached carcasses from January to December 2005.

recording findings onto a standard datasheet (Appendix I). The information recorded for each carcass located included species (if possible), stage of decomposition, age and sex (if possible), evidence of scavenging, evidence for the cause of death, the presence of oil, and whether a photograph was taken. Carcass location was recorded with a hand-held GPS unit and photographs of carcasses were taken using a Canon PowerShot A70 digital camera. Data were later entered into an Access (Microsoft Corp., Redmond, Washington) database created by the NPS. Location data were entered into ArcView GIS (ESRI, Redlands, California) to aid in correlating beach use by the eagles with known carcass locations.

When possible, we placed a video camera near marine mammal carcasses to record foraging occurrences by bald eagles. The system consisted of a tripod-mounted color video camera in a weatherproof housing, a VCR in a modified Pelican case, a 12-volt deep-cycle battery, and a flexible solar panel. In order to ensure the safety of the equipment it had to be placed well above high tide near the carcass and the site had to receive direct sunlight for at least several hours per day to recharge the battery.

Trapping

In 2005, we continued efforts to trap older bald eagles to collect follow-up blood and feather samples for contaminants and stable isotope analyses. Trap sites were selected in areas where bald eagles were frequently observed. Prior to trapping efforts we placed pig carcasses at the trap site to attract eagles to the area. A bownet was placed in the ground, covered with dirt and grass, and baited with a pig hindquarters. Traps were set before daylight and observed from a blind. If a target bald eagle entered the trap we tripped the trigger with a remote control. We collected approximately 10 cc of blood and several breast feathers from each trapped bird. Trapped eagles were also given a West Nile vaccine and if necessary their transmitter was replaced with a refurbished unit.

Tissue Sampling

To determine bald eagle exposure to contaminants through their diet and to create a stable isotope food web model, samples of bald eagle blood and feathers, and other tissue (muscle and adipose) samples of feral pigs, marine mammals, and seabirds were collected for analyses. These sample analyses will be used to predict the likelihood of successful future bald eagle reproduction on the northern Channel Islands. The protocol for tissue collection was developed by the FWS and IWS (Appendix II) and finalized in September 2003. Samples were stored in chemically clean glass containers and frozen for later shipment to the Woods Hole Group for DDE/PCB analyses, and Northern Arizona University for stable isotope analyses.

RESULTS

Bald Eagle Acquisition

On 1 June, seven young bald eagles produced at the San Francisco Zoo's ACC facility were flown by private plane to Camarillo, California. These birds were taken by boat to Santa Cruz Island on the morning of 2 June and placed in the South Tower.

On 22 June we transported three eaglets produced at the ACC to Santa Cruz Island by plane. These birds were placed into the North Tower. The remaining two birds, one from the ACC and one from Alaska that had recovered from avian pox, were transported to Santa Cruz Island on 7 July and placed in the North Tower.

Bald Eagle Hacking

Three birds from the ACC that were placed into the South Tower were banded on 29 June (Table 1). We banded the remaining four birds in the South Tower on 30 June. These birds were released on 2 July. The birds in the North Tower were banded on 15 July and released on 20 July (Table 1).

Post-Release Monitoring

IWS personnel began daily post-fledging tracking and monitoring of the eagles as soon as the nest box doors were opened. Food, in the form of feral pig carcasses, was placed in front of the hack tower initially, and then moved further from the towers to encourage the young birds to search for food.

Table 1. Identification, release information, and current status of bald eagles released on Santa Cruz Island, California 2005.

FWS Leg Band	Sex[a]	Patagial Marker	Source[b]	Release Point	Release Date	Status/Latest Location[c]
629-47385	F	A-34	Zoo	SouthTower, Box 3	7/02/05	Alive on Santa Rosa Island
629-47386	F	A-35	Zoo	South Tower, Box 3	7/02/05	Orange Co. Birds of Prey
629-47387	F	A-36	Zoo	South Tower, Box 3	7/02/05	Alive on Santa Cruz Island
629-47388	F	A-37	Zoo	South Tower, Box 4	7/02/05	Alive on Santa Cruz Island
629-47389	M	A-38	Zoo	South Tower, Box 4	7/02/05	Died in WA around 9/26/05
629-47390	M	A-39	Zoo	South Tower, Box 4	7/02/05	Alive in Washington State
629-47391	M	A-40	Zoo	South Tower, Box 4	7/02/05	Alive on Santa Cruz Island
629-47392	M	A-41	AK	North Tower, Box 2	7/12/05	Died on Santa Cruz 11/4/05
629-47393	F	A-42	Zoo	North Tower, Box 2	7/12/05	Alive on Santa Rosa Island
629-47399	F	A-43	Zoo	North Tower, Box 1	7/20/05	Alive on Santa Rosa Island
629-47400	M	A-44	Zoo	North Tower, Box 1	7/20/05	Alive on Santa Rosa Island
629-02800	M	A-45	Zoo	North Tower, Box 1	7/20/05	Alive on Santa Cruz Island

[a] Determined by karyotyping for birds from San Francisco Zoo, California and morphometrics for Alaskan birds.

[b] Bald eagles from the San Francisco Zoo, California (Zoo), wild nests near Juneau, Alaska (AK).

[c] Status as of 31 December 2005.

A-34 Movements

Eagle A-34 remained on Santa Cruz Island until 5 October, at which time it flew to Santa Rosa Island. It remained on Santa Rosa through the rest of 2005 (Fig. 5).

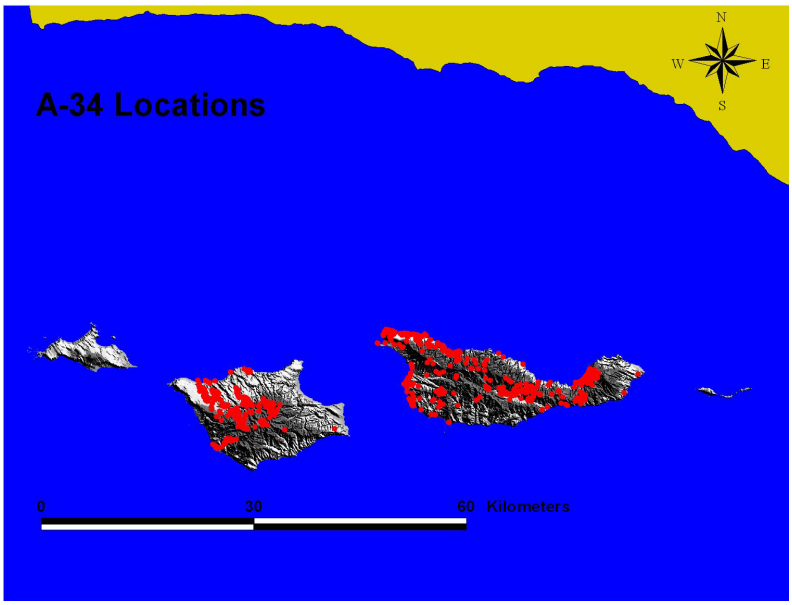

Figure 5. Movements of Bald Eagle A-34 on the northern Channel Islands, California in 2005.

A-35 Movements

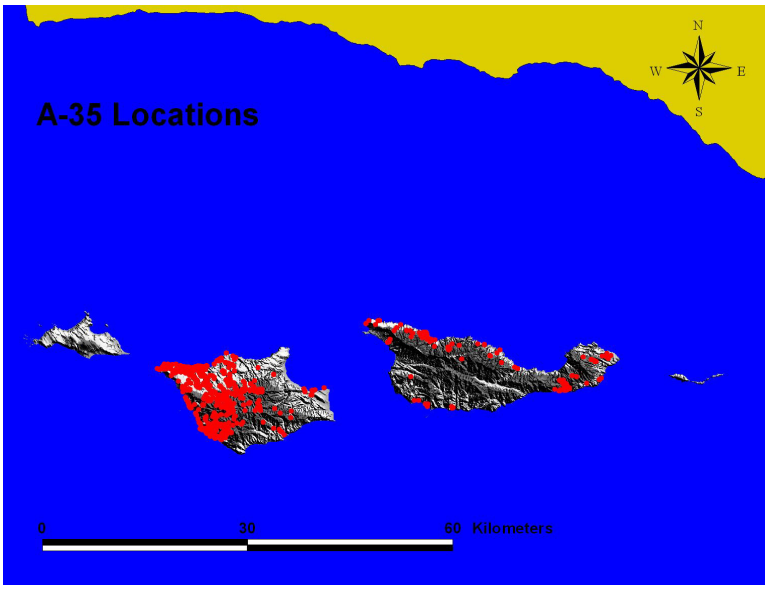

Figure 6. Movements of Bald Eagle A-35 on the northern Channel Islands, California in 2005.

Eagle A-35 remained on Santa Cruz Island for about 1.5 months following its release. On 16 August it flew to Santa Rosa Island, where it remained until December (Fig. 6). In mid-December the GPS data indicated that the bird was not moving more than 50 m per day. On 19 December we flew to Santa Rosa Island and found A-35 on the ground with a broken wing. It was transported to the mainland on 20 December and examined by IWS veterinarian Winston Vickers. Blood was collected for analyses and the bird was found also to have lead poisoning, with a blood lead level of 52.2 micrograms/dl ("normal" level for eagles and condors is 6 - 12 micrograms/dl according to IDEXX, Westbrook, ME). The bird was then transported to the Orange County Birds of Prey Center where it underwent treatment for lead poisoning and for the broken wing. We plan on releasing it back onto Santa Cruz Island in the spring of 2006.

A-36 Movements

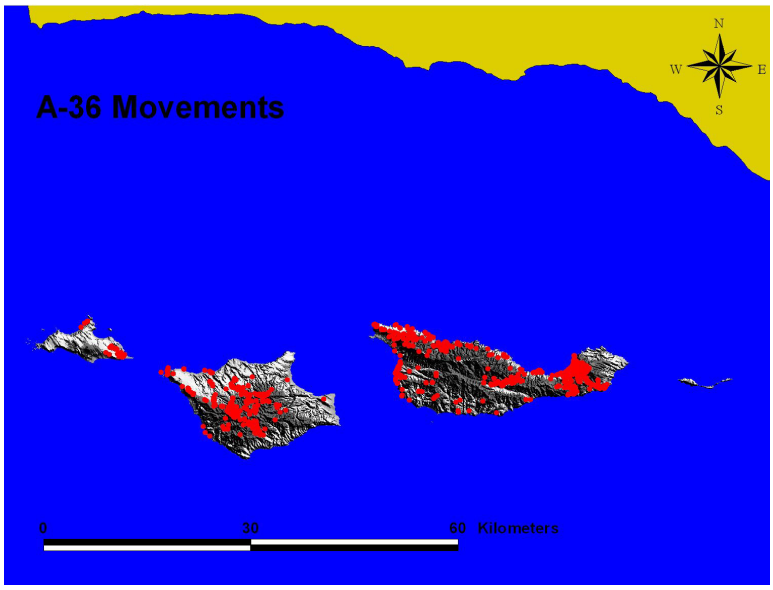

Figure 7. Movements of Bald Eagle A-36 on the northern Channel Islands, California in 2005.

Eagle A-36 remained on Santa Cruz Island until 28 September. It flew to Santa Rosa Island and remained there until at least 11 November. There was a gap in the GPS data until 15

November, at which time the bird was on San Miguel Island. It flew back to Santa Rosa Island on 19 November, stayed a week, and then flew to Santa Cruz Island, where it remained through December (Fig. 7).

A-37 Movements

Eagle A-37 remained on Santa Cruz Island until 28 September, at which time it flew to Santa Rosa Island. It remained on Santa Rosa Island until 27 November before returning to Santa Cruz Island. It remained on Santa Cruz through the end of the year (Fig. 8).

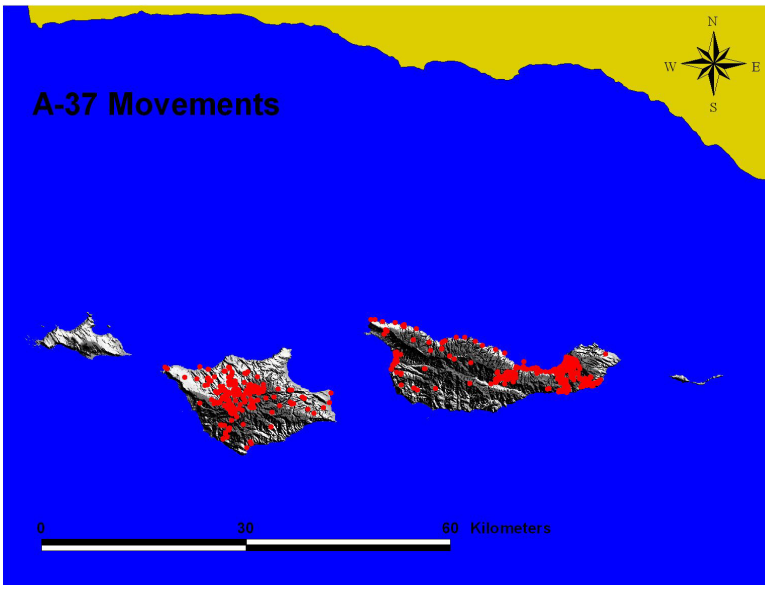

Figure 8. Movements of Bald Eagle A-37 on the northern Channel Islands, California in 2005.

A-38 Movements

Eagle A-38 stayed on Santa Cruz Island until 18 July and then flew to Anacapa Island for nearly a month. It returned to Santa Cruz for two days on 17 August and then began making regular flights between Santa Cruz and Anacapa Islands every 2-6 days until 5 September. On 5 September, A-38 flew due east from Anacapa Island to the mainland between 1400 and 1500 hours. It crossed into Oregon on 11 September and into

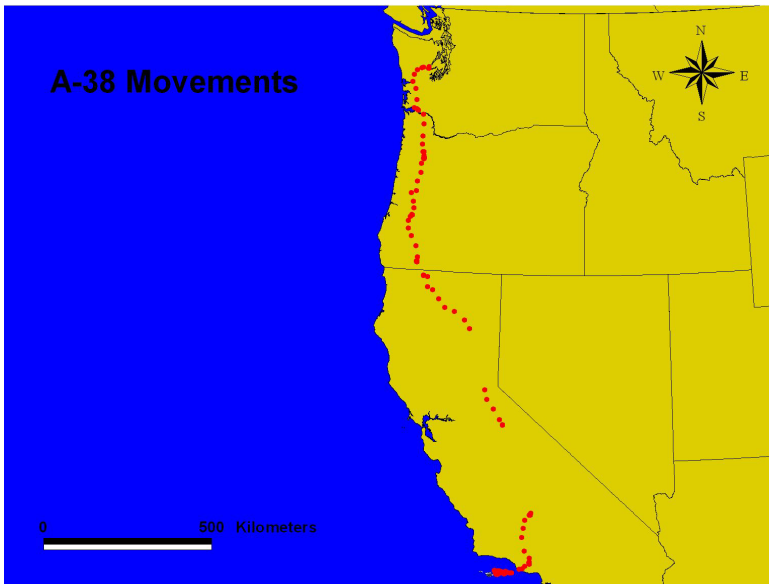

Figure 9. Movements of Bald Eagle A-38 in the western United States in 2005.

Washington on 17 September (Fig. 9). On 27 September we received a report that the bird had been found dead in a flume at a private trout farm. It had apparently been unable to extricate itself from the narrow flume and either drowned or died of hypothermia.

A-39 Movements

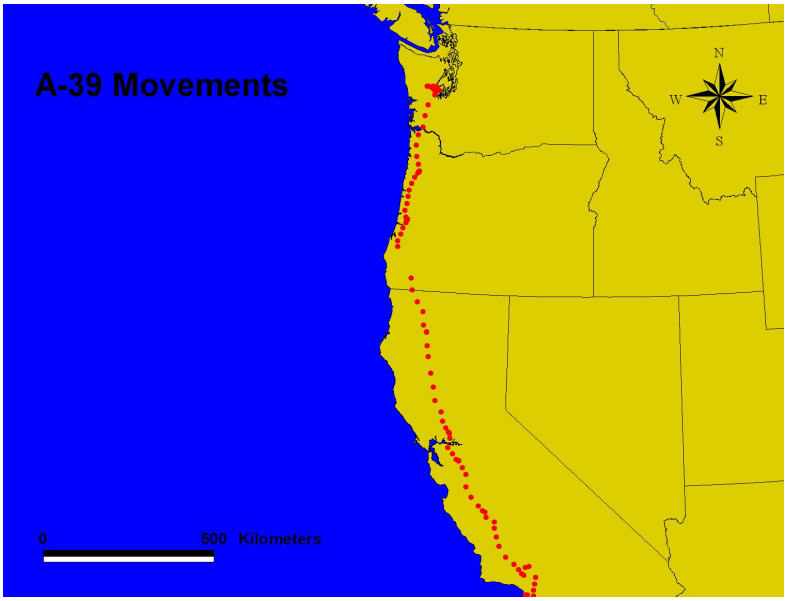

Figure 10. Movements of Bald Eagle A-39 in the western United States in 2005.

Eagle A-39 stayed on Santa Cruz Island until 18 August, at which time it flew due east to the mainland between 1300 and 1700 hours (Fig. 10). It crossed into Oregon on 24 August and into Washington on 27 August. It stayed near the southernmost arm of the Puget Sound until we lost its satellite data on 29 October and did not receive any more information through the end of the year (it began transmitting again in 2006). A-38 and A-39 ended up within 5 km of each other in Washington, even though they left the islands at different times and took different routes north (Figs. 9 and 10).

A-40 Movements

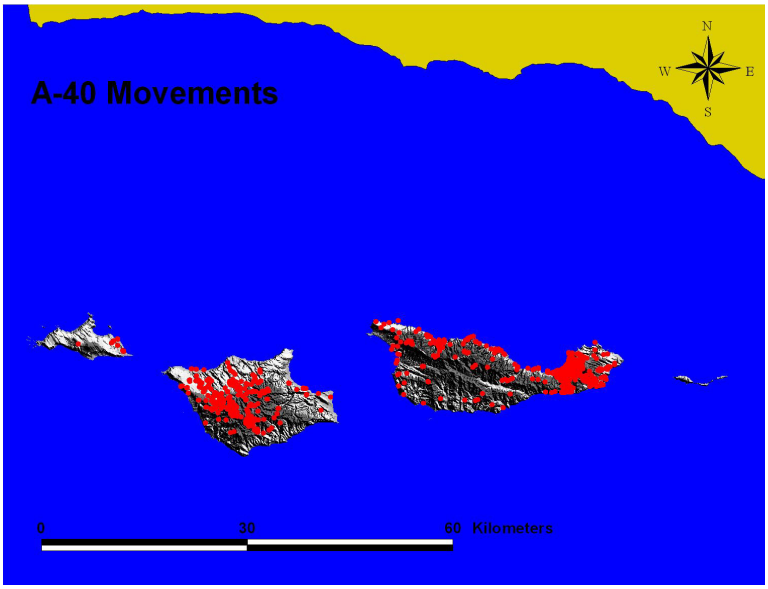

Figure 11. Movements of Bald Eagle A-40 on the northern Channel Islands, California in 2005.

Eagle A-40 remained on Santa Cruz Island until 9 September. It spent 9 September through 28 September on Santa Rosa Island and then spent two days on San Miguel Island (Fig.

11). The bird returned to Santa Rosa Island on 30 September and then returned to Santa Cruz Island for two days on 15 October. It spent 16 October through 22 November on Santa Rosa before returning to Santa Cruz, where it spent the rest of the year.

A-41 Movements

Eagle A-41 was originally removed from a nest in Alaska in 2004. Once on Santa Cruz Island it started showing signs of an infection of avian pox. It was kept in captivity on Santa Cruz Island, and then later on Santa Catalina Island, until its lesions disappeared in 2005. Once released it spent most of its time on the beaches on the eastern end of the island (Fig. 12). We observed the bird many times, but it never seemed to leave the beaches on the eastern portion of the island. We continued to monitor the bird until it was found dead near the beach at Valley Anchorage on 4 November. Cause of death was possibly starvation because it did not move into the interior of the island where there was plentiful food in the form of feral pig carcasses.

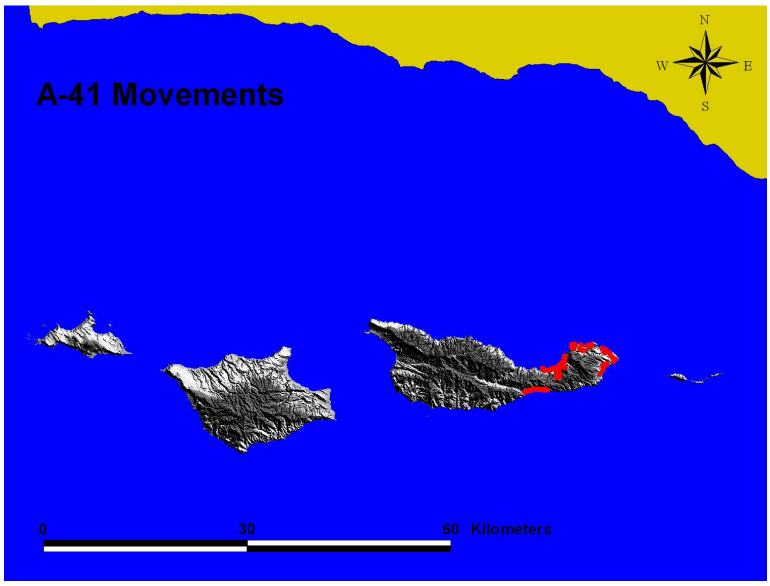

Figure 12. Movements of Bald Eagle A-41 on the northern Channel Islands, California in 2005.

A-42 Movements

Eagle A-42 stayed on Santa Cruz Island until 25 July. It then flew to Anacapa Island where is stayed until 18 August (Fig. 13). It then flew back to Santa Cruz Island, spending less than a week on the island. It left Santa Cruz around noon on 23 August, spending less than five hours on Santa Rosa Island before flying to San Miguel Island (visited three islands in less than 5 hours). It stayed on San Miguel for a day before returning to Santa Rosa Island, where it spent the rest of the year.

A-43 Movements

Eagle A-43 remained on Santa Cruz Island through 5 October, except for a one hour visit to Anacapa Island on 12 September. On 6 October it flew to Santa Rosa Island, where it remained until 16 October. On 16 October it flew to San Miguel Island, but returned to Santa Rosa by 17 October, where it remained through the rest of the year (Fig. 14).

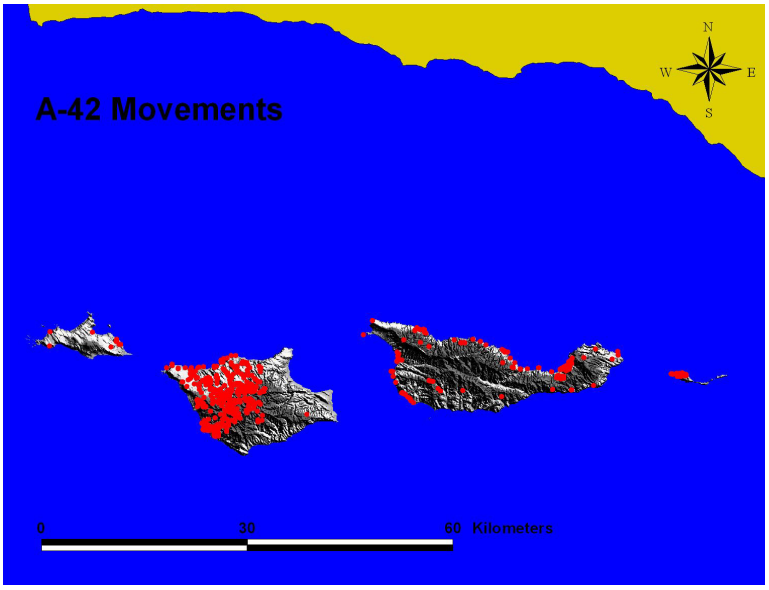

Figure 13. Movements of Bald Eagle A-42 on the northern Channel Islands, California in 2005.

A-44 Movements

Eagle A-44 remained on Santa Cruz Island until 30 July, when it flew to Anacapa Island. It remained on Anacapa for nearly a month before returning to Santa Cruz Island on 27 August (Fig. 15). It stayed on Santa Cruz until it flew to Santa Rosa Island on 20 September, where it remained through the end of the year.

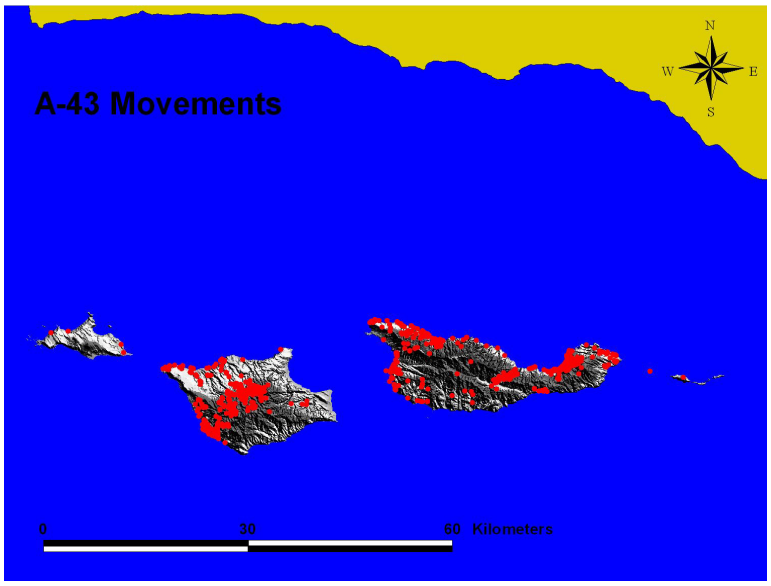

Figure 14. Movements of Bald Eagle A-43 on the northern Channel Islands, California in 2005.

A-45 Movements

Eagle A-45 moved among the four northern Channel Islands more than any other 2005 release (Fig. 16). After its release, it stayed on Santa Cruz Island until 12 August, at which time it flew to Anacapa Island. It returned to Santa Cruz Island on 17 August, where it remained until 10 September. It flew to Anacapa Island on 10 September, returned to Santa Cruz on 11 September, flew back to Anacapa on 12 September, and returned to Santa Cruz on 13 September. A-45 remained on Santa Cruz until 28 September, at which time it flew to Santa Rosa Island. It flew to San Miguel Island on 16 October, returned to Santa Rosa Island on 17 October, and then flew to Santa Cruz Island on 12 December, where it remained through the end of the month.

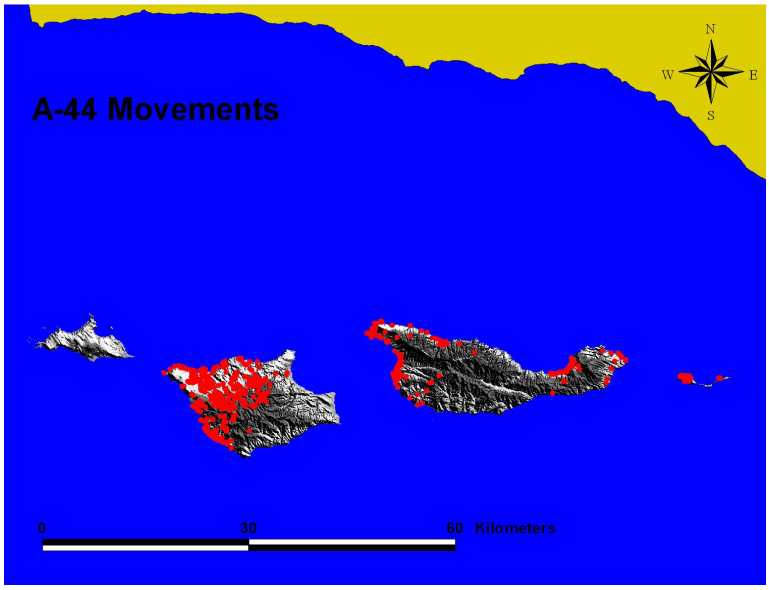

Figure 15. Movements of Bald Eagle A-44 on the northern Channel Islands, California in 2005.

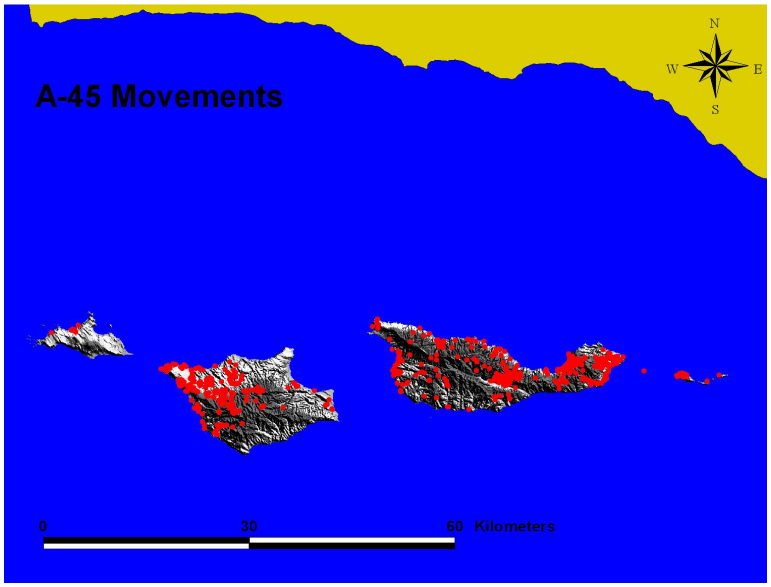

Figure 16. Movements of Bald Eagle A-45 on the northern Channel Islands, California in 2005.

In addition to monitoring the newly released eagles, IWS continued to monitor the birds released in 2002 through 2004. Below is a brief summary of the movements and status of these birds during 2005. Each bird is referred to by its patagial tag number (Table 2).

Table 2. Identification, release information, and current status of bald eagles released on Santa Cruz Island, California during 2002-2004.

FWS Leg Band	Sex[1]	Patagial Marker	Source[2]	Release Point	Release Date	Fledge Date	Status, Latest Location[3]
629-02795	M	A-00	Zoo	North Tower, Cage 1	6/25/02	6/26/02	Alive, Santa Cruz Is.
629-02796	F	A-01	Zoo	North Tower, Cage 1	6/25/02	6/28/02	Unknown
629-02798	F	A-02	Zoo	North Tower, Cage 2	6/25/02	6/30/02	Alive, Santa Cruz Is.
629-02797	F	A-03	Zoo	North Tower, Cage 2	6/25/02	6/30/02	Dead
629-14042	F	A-04	Alaska	North Tower, Cage 2	8/15/02	8/15/02	Alive, Santa Cruz Is.
629-14041	F	A-05	Alaska	North Tower, Cage 2	8/15/02	8/15/02	Dead
629-14043	M	A-06	Zoo	North Tower, Cage 1	8/19/02	8/20/02	Alive, Santa Rosa Is.
629-14044	M	A-07	Alaska	North Tower, Cage 1	8/17/02	8/20/02	Dead
629-14045	M	A-08	Alaska	South Tower, Cage 3	8/26/02	8/27/02	Alive, Santa Rosa Is.
629-14046	F	A-09	Alaska	South Tower, Cage 3	8/26/02	8/27/02	Dead
629-14047	F	A-10	Alaska	South Tower, Cage 4	9/7/02	9/9/02	Alive, Santa Rosa Is.
629-14048	F	A-11	Alaska	South Tower, Cage 4	9/7/02	9/9/02	Alive, Santa Cruz Is.
629-47354	F	A-12	Zoo	North Tower, Cage 2	6/13/03	6/13/03	Alive, mainland
629-47355	F	A-13	Zoo	North Tower, Cage 2	7/01/03	7/01/03	Alive, mainland
629-47364	M	NA	Zoo	North Tower, Cage 1	7/25/03	7/25/03	Alive, Rehab.
629-47361	F	A-14	Alaska	South Tower, Cage 3	8/21/03	8/23/03	Dead
629-47357	M	A-15	Zoo	North Tower, Cage 1	7/25/03	7/25/03	Dead
629-47359	F	A-16	Alaska	South Tower, Cage 3	8/21/03	8/22/03	Alive, Santa Rosa Is.
629-47360	F	A-17	Alaska	South Tower, Cage 3	8/21/03	8/23/03	Alive, Santa Rosa Is.
629-47362	F	A-18	Alaska	South Tower, Cage 4	8/21/03	8/23/03	Dead
629-47363	F	A-19	Alaska	South Tower, Cage 4	8/21/03	8/21/03	Alive, Santa Cruz Is.
629-47358	F	A-20	Alaska	North Tower, Cage 2	8/31/03	9/02/03	Dead
629-47356	M	A-21	Alaska	North Tower, Cage 2	8/31/03	9/02/03	Alive, Santa Cruz Is.
629-47365	F	A-22	Zoo	North Tower, Cage 1	7/09/04	7/09/04	Alive, Santa Cruz Is.
629-47366	F	A-23	Zoo	North Tower, Cage 2	7/26/04	7/26/04	Unknown
629-47372	F	A-24	Alaska	South Tower, Cage 4	8/18/04	8/31/04	Alive, Santa Rosa Is.
629-47373	M	A-25	Alaska	South Tower, Cage 4	8/18/04	8/18/04	Dead
629-47374	M	A-26	Alaska	South Tower, Cage 4	8/18/04	8/23/04	Dead

Table 2. Continued.

FWS Leg Band	Sex[1]	Patagial Marker	Source[2]	Release Point	Release Date	Fledge Date	Status, Latest Location[3]
629-47375	F	A-27	Alaska	South Tower, Cage 3	8/19/04	8/27/04	Alive, Santa Rosa Is.
629-47376	M	A-28	Alaska	South Tower, Cage 3	8/19/04	8/24/04	Alive, Santa Rosa Is
629-47377	M	A-29	Alaska	South Tower, Cage 3	8/19/04	8/23/04	Alive, Santa Cruz Is.
629-47378	F	A-30	Rehab	South Tower, Cage 4	8/19/04	8/19/04	Dead
629-47379	F	A-31	Alaska	North Tower, Cage 1	9/12/04	9/12/04	Unknown
629-47380	F	A-32	Alaska	North Tower, Cage 1	9/12/04	9/12/04	Alive, Santa Cruz Is.
629-47381	M	A-33	Alaska	South Tower, Cage 4	10/9/04	10/9/04	Alive, Santa Cruz Is.

[1] Determined by karyotyping for birds from San Francisco Zoo, and morphometrics for Alaskan birds.
[2] Bald eagles from the Avian Conservation Center, San Francisco Zoo, California (Zoo), wild nests near Juneau, Alaska (Alaska), or Shasta Wildlife Rescue and Rehabilitation Center, Redding, California (Rehab).
[3]As of 12/31/05.

A-00 Movements

A-00 has visited all of the northern Channel Islands and the mainland since its release in 2002. The bird's GPS transmitter fell off on Anacapa in May 2003. The bird was observed on Santa Cruz Island on 17 March 2005.

A-02 Movements

Eagle A-02 was recaptured on Santa Cruz Island on 7 April 2005 and equipped with a new GPS/VHF transmitter. It spent most of 2005 on Santa Cruz Island (Fig. 17), although it flew to Santa Rosa Island on 28 September and remained there through at least 15 October. We received no GPS data from 16-24 October, but the bird had returned to Santa Cruz Island

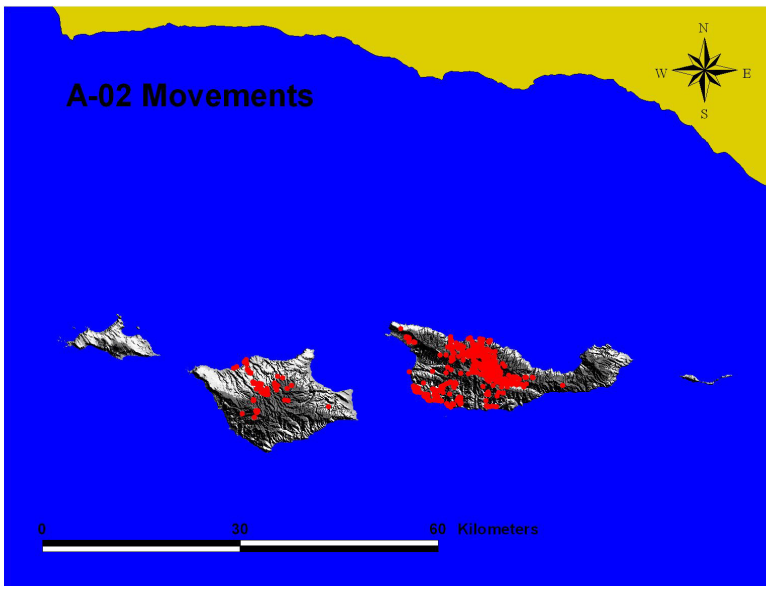

Figure 17. Movements of Bald Eagle A-02 on the northern Channel Islands, California in 2005.

by 25 October and remained there through the rest of the year. This bird appears to be forming a territory in the Lady's Harbor area on the north side of Santa Cruz Island.

Figure 18. Bald Eagle A-04 when it was recaptured on Santa Cruz Island, California on 12 August 2005.

A-04 Movements

Eagle A-04 was recaptured on 12 August 2005 and equipped with a new GPS/VHF transmitter (Fig. 18). She remained on Santa Cruz Island until 11 September, at which time she flew to Anacapa Island for a day, returning to Santa Cruz on 12 September (Fig. 19). On 16 October, she flew to Santa Rosa Island and remained there through 25 November. On 26 November, she returned to Santa Cruz Island and remained there through December. Most of her GPS points were in the Punta Arena area on the southwest portion of the island in the later part of the year, suggesting she may be establishing a territory there.

A-10 Movements

Eagle A-10 dropped its transmitter in December 2002. It was seen on Santa Rosa Island on 22 April 2005.

A-11 Movements

Eagle A-11 dropped its transmitter in September 2003. There have been several sightings

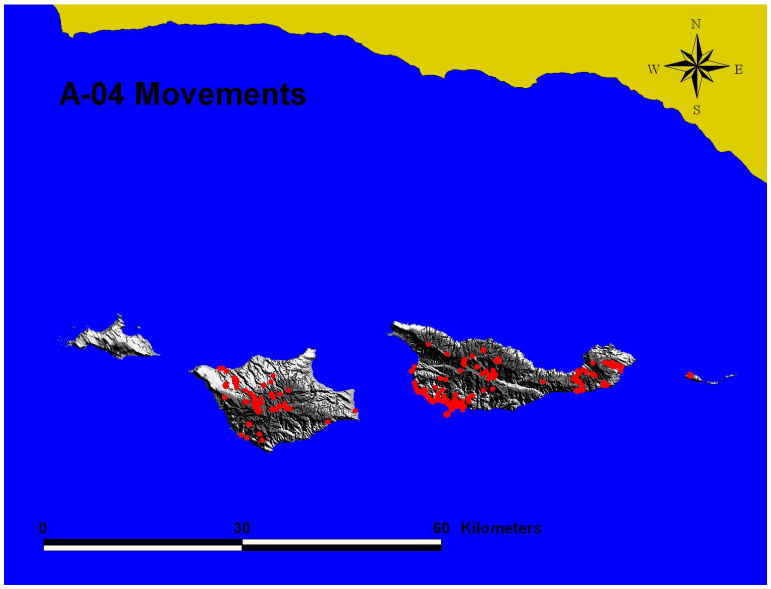

Figure 19. Movements of Bald Eagle A-04 on the northern Channel Islands, California in 2005.

of this bird on Santa Cruz Island, the most recent on 4 June 2005.

A-13 Movements

Eagle A-13 dropped its transmitter in Montana in July 2004. It was last seen at Lake Cachuma, Santa Barbara County on 8 July 2005.

A-14 Movements

Eagle A-14's GPS signal stopped moving on Santa Rosa Island in October 2004. We were unable to get to the island to recover the transmitter in 2004. On 25 January 2005, Brian Latta located the transmitter and carcass of the eagle. Its foot appeared caught in a bush (Fig. 20), but the cause of death could not be determined.

Figure 20. Carcass of A-14 as it was found on Santa Rosa Island in January 2005.

A-16 Movements

Eagle A-16 remained on Santa Rosa Island from 1 January until 19 April. It then flew to Santa Cruz Island and remained there until 28 September. It returned to Santa Rosa Island and stayed there until we stopped receiving satellite GPS data on 16 October (Fig. 21).

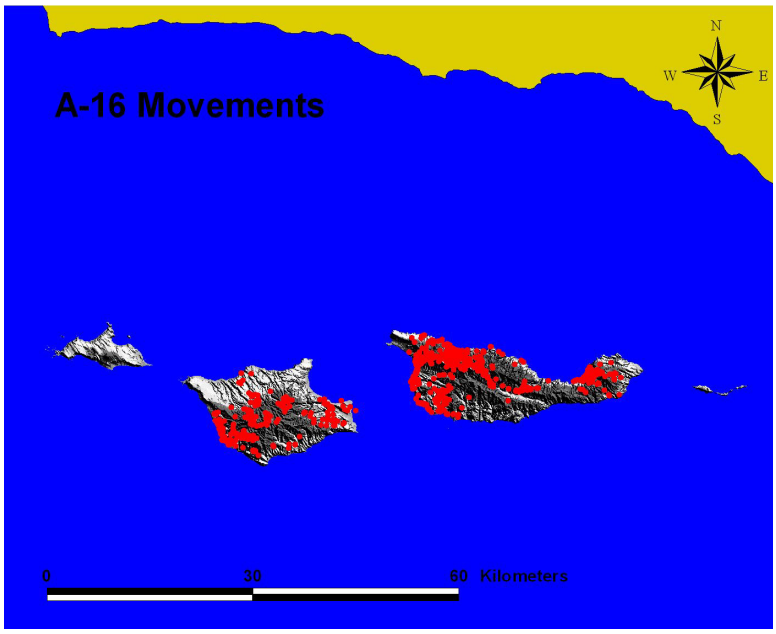

Figure 21. Locations for Bald Eagle A-16 on the northern Channel Islands, California in 2005.

A-17 Movements

Eagle A-17 dropped its transmitter in April 2004. It was last seen on Santa Rosa Island on 16 September 2005.

A-18 Movements

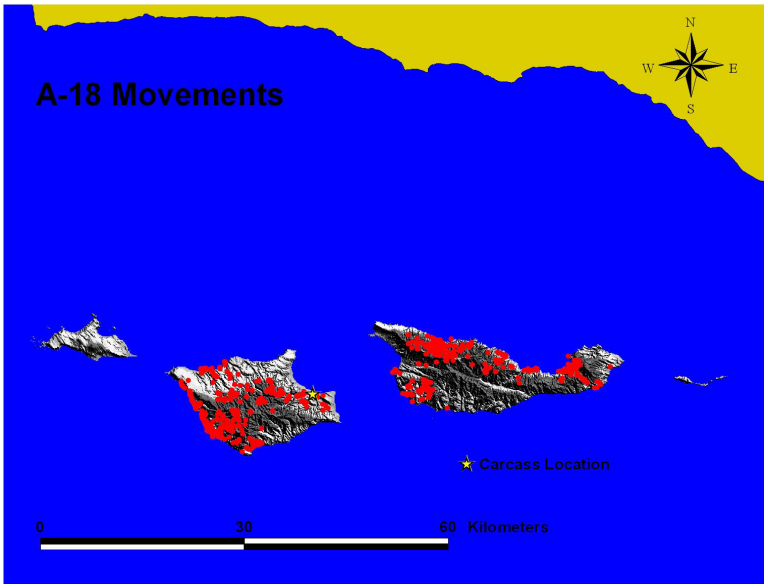

Figure 22. Locations for Bald Eagle A-18 on the northern Channel Islands, California in 2005.

Eagle A-18 spent most of 2005 moving between Santa Rosa and Santa Cruz Islands (Fig. 22). It began the year on Santa Rosa Island and remained there until 16 March, at which time it flew to Santa Cruz Island. It remained on Santa Cruz Island for 10 days before returning to Santa Rosa Island on 27 March. On 7 April it returned to Santa Cruz Island, staying until 13 May. It stayed on Santa Rosa Island from 13 – 21 May, on Santa Cruz Island from 21 May to 12 June, back on Santa Rosa Island from 12 June to 3 July, and on Santa Cruz from 5 – 22 July. It returned to Santa Rosa Island on 23 July and stayed there through August. GPS data downloaded in early September indicated that the signal stopped moving on 31 August. We went to Santa Rosa Island on 16 September to get what we thought was probably a dropped transmitter, but instead found A-18 dead in a small creek (Fig. 23).

Figure 23. Carcass of Bald Eagle A-18 recovered on Santa Rosa Island.

A-19 Movements

Eagle A-19 dropped its transmitter in October 2004. It was seen on Santa Cruz Island on 15 October 2005.

A-20 Movements

Eagle A-20 spent the first part of the year on Santa Rosa Island. It flew to Santa Cruz Island on 23 March and then flew to the mainland on 22 April (Fig. 24). A-20 moved around the mainland until 23 May, at which time the GPS data showed that the bird had stopped moving. We recovered the carcass west of Santa Barbara on 6 June (Fig. 24), but were unable to determine the cause of death.

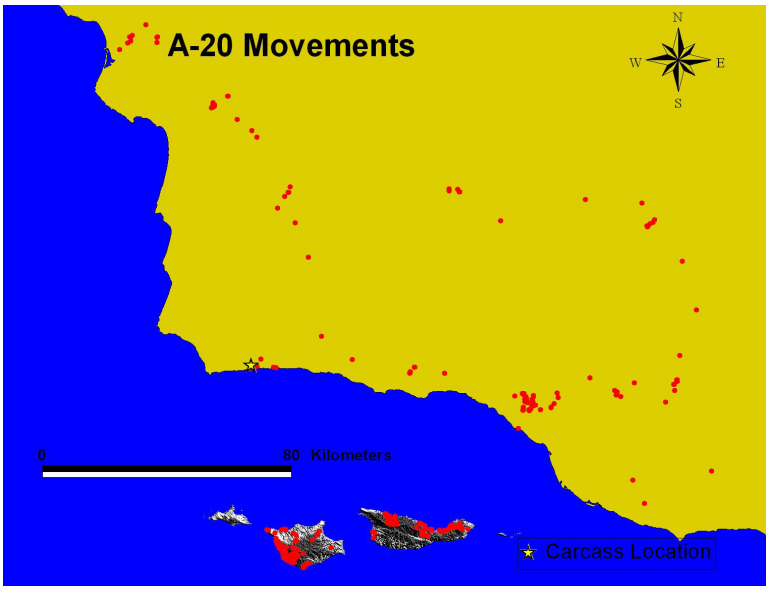

Figure 24. Locations of Bald Eagle A-20 in southern California in 2005.

A-21 Movements

Eagle A-21 moved among the islands more than any other transmittered bird in 2005 (Fig. 25). It started the year on Santa Cruz Island, flew to Santa Rosa Island on 16 January, flew back to Santa Cruz on 12 February, returned to Santa Rosa on 26 February, and then back to Santa Cruz on 16 March. A-21

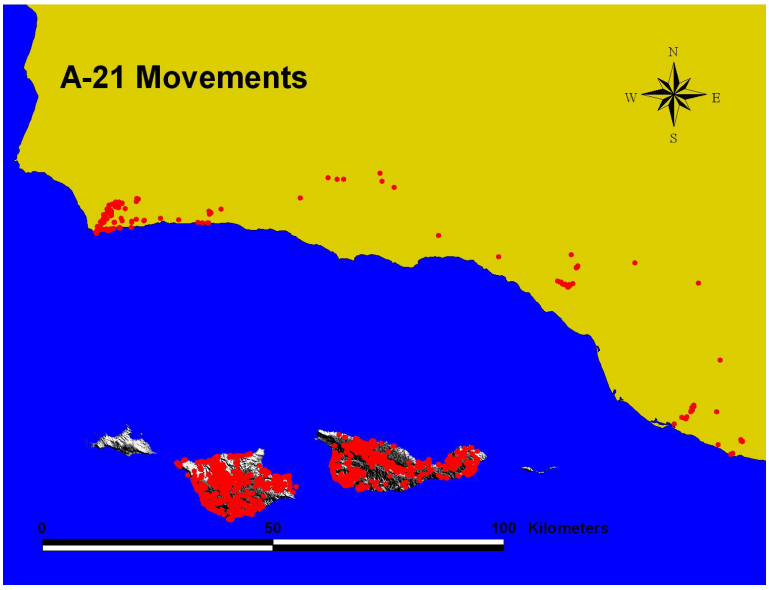

Figure 25. Locations of Bald Eagle A-21 in southern California in 2005.

flew due east to the mainland on 20 March between 1100 and 1500 hours. It moved around the mainland until 8 April, at which time it returned to Santa Rosa Island. The rest of the year was spent on Santa Rosa (4/8-4/19, 5/30-6/18, 7/12-8/15, 8/23-10/9, 10/25-11/23, 12/9-12/2) and Santa Cruz Islands (4/19-5/29, 6/18-7/12, 8/16-8/22, 10/10-10/25, 11/23-12/9, 12/29-12/31).

A-22 Movements

Eagle A-22 spent 1 January through 27 March on Santa Rosa Island (Fig. 26). On 27 March is flew to Santa Cruz Island, moved around the island through 3 April, and then flew to Anacapa Island on 4 April. It spent nearly two weeks on Anacapa Island before returning to Santa Cruz Island on 17 April. Its GPS unit stopped transmitting data on 25 April, at which time it was on the northwestern portion of Santa Cruz Island.

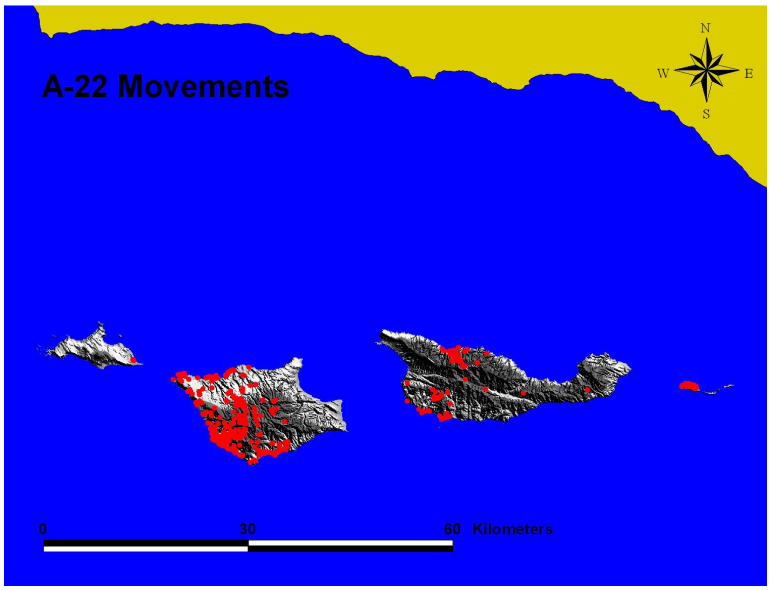

Figure 26. Locations of Bald Eagle A-22 on the northern Channels Islands, California in 2005.

A-24 Movements

Eagle A-24 spent time on Santa Rosa Island, Santa Cruz Island, and the mainland in 2005 (Fig. 27). It spent 1 January – 19 February on Santa Rosa Island, flew to Santa Cruz Island on 19 February, returned to Santa Rosa Island on 23 February, and then flew back to

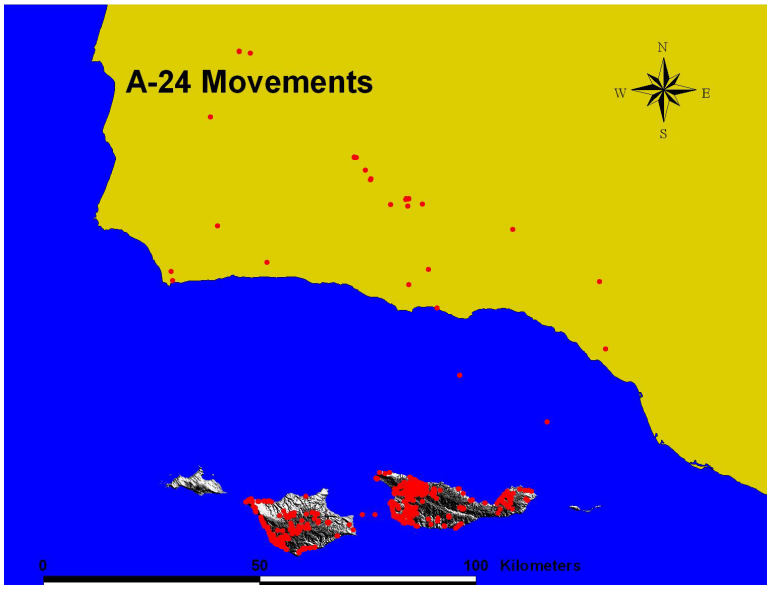

Figure 27. Locations of Bald Eagle A-24 in southern California in 2005.

Santa Cruz Island on 23 March. On 25 March the bird flew to the mainland at 1200 hours and spent a few days moving around southern California. It returned to Santa Cruz Island on 29 March and stayed on that island until 10 May before returning to Santa Rosa Island. It flew back to Santa Cruz Island on 17 May and stayed until 21 July. It flew back to Santa Rosa and remained there until we stopped getting data on 27 August. The dropped transmitter was retrieved on 17 September.

A-25 Movements

Eagle A-25's transmitter stopped transmitting on San Miguel Island in October 2004. In September 2005 the GPS unit began transmitting data again on San Miguel Island. Tessa Smith (NPS) recovered the remains of the bird on 3 October near Point Bennett.

A-27 Movements

Eagle A-27, like Eagle A-24, moved between Santa Rosa and Santa Cruz Islands often in 2005 (Fig. 28). The two eagles appear to have been traveling together during the first quarter of the year. A-27's movements between the islands were identical to A-24's movements through 25 March. After A-24 flew to the mainland, A-27 returned to Santa Rosa Island from 26 March until 3 April, before returning to Santa Cruz Island. It stayed on Santa Cruz Island until 7 May and then returned to Santa Rosa Island. It visited three islands on 8 May. It started the day on Santa Rosa Island, flew to San Miguel Island for two hours, returned to Santa Rosa Island for 2 hours, and then flew to Santa Cruz Island, where

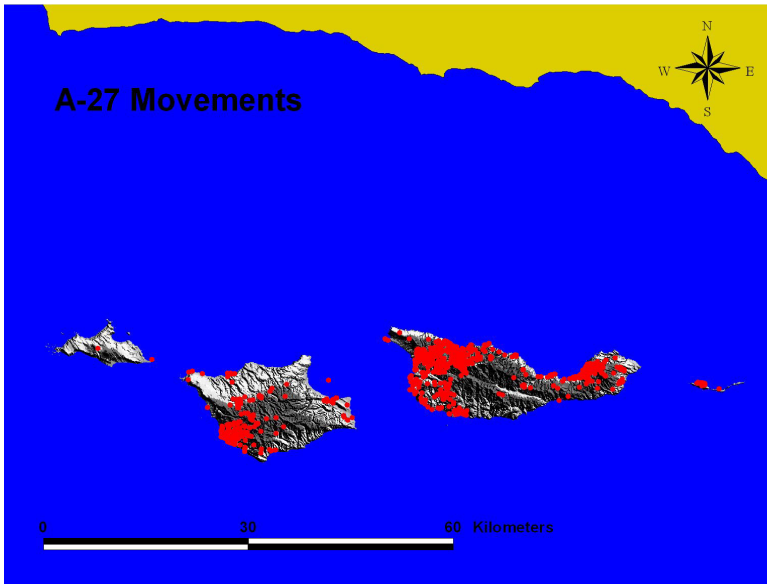

Figure 28. Locations of Bald Eagle A-27 on the northern Channel Islands, California in 2005.

it remained until 22 May. Its next trip to Santa Rosa lasted less than a week and the bird returned to Santa Cruz Island for the time period 28 May through 6 June. It flew to Anacapa Island on 6 June, returning to Santa Cruz on 11 June. This last known trip to Santa Cruz lasted until it flew to Santa Rosa Island on 26 August. Its transmitter stopped moving on 6 September and the dropped transmitter was recovered on 17 September.

A-28 Movements

Eagle A-28 only moved between the islands three times in 2005. It spent 1 January – 23 March on Santa Rosa Island, 23 March – 5 October on Santa Cruz Island, and then returned to Santa Rosa Island and stayed through December (Fig. 29).

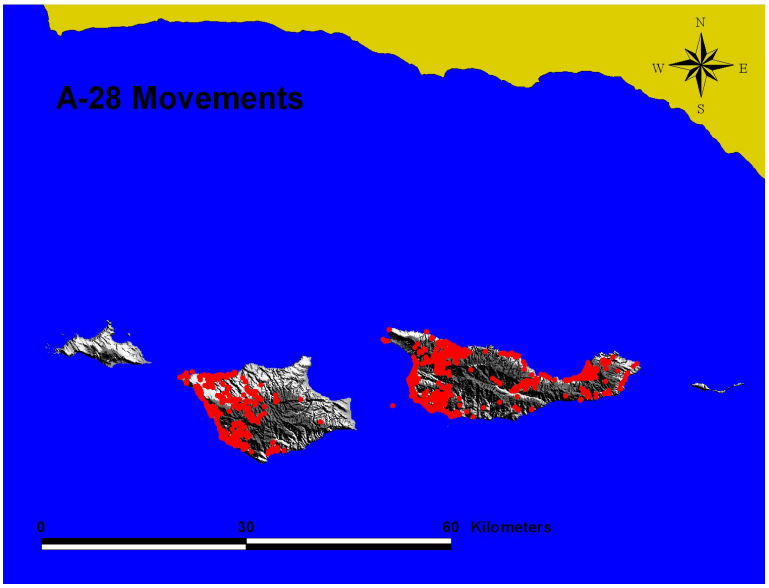

Figure 29. Locations of Bald Eagle A-28 on the northern Channel Islands, California in 2005.

A-29 Movements

Unlike the other older eagles, Eagle A-29 spent the entire year on Santa Cruz Island (Fig. 30).

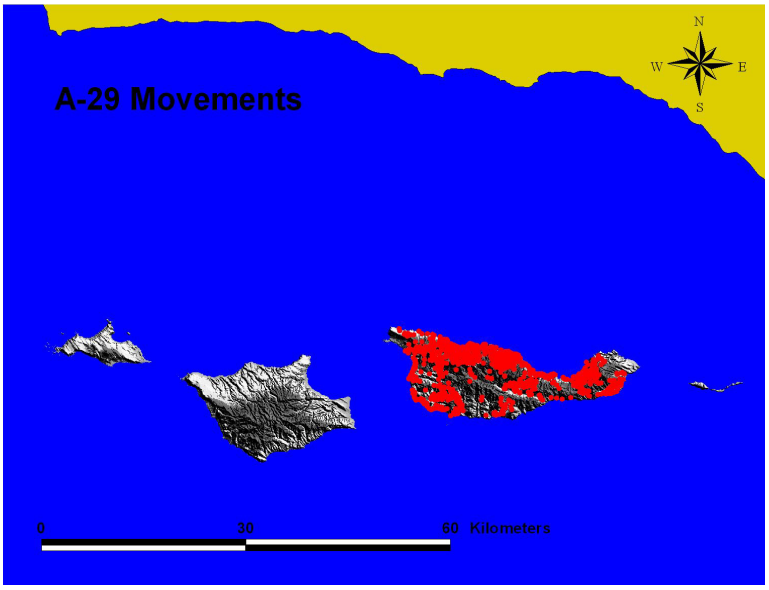

Figure 30. Locations of Bald Eagle A-29 on the northern Channel Islands, California in 2005.

A-30 Movements

Eagle A-30 spent 1 January through 25 April on Santa Rosa Island. On 25 April it flew to Santa Cruz Island and spent a day there. On 26 April it flew east and ended up in the ocean south of Anacapa

Island (Fig. 31). The GPS data showed the bird floating in the ocean until 4 May. On 7 May the carcass was recovered on Venice Beach, California.

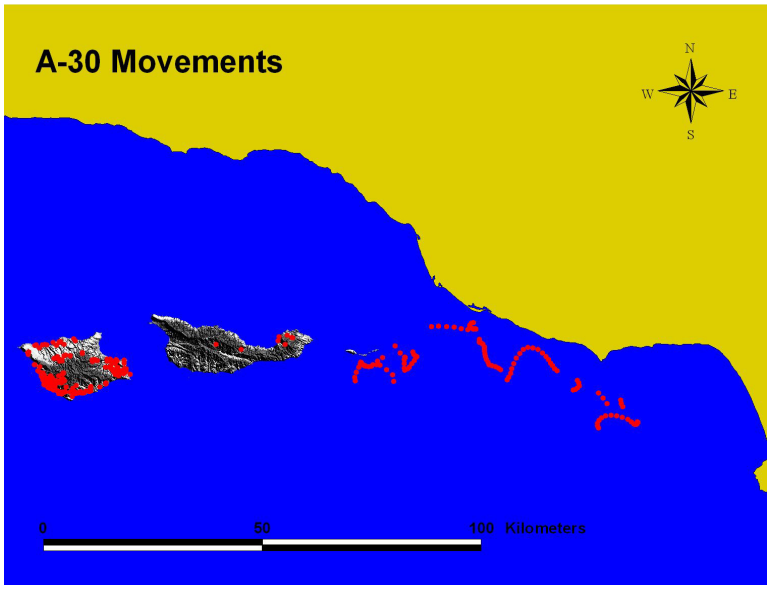

Figure 31. Locations of Bald Eagle A-30 in southern California in 2005.

A-32 Movements

Eagle A-32 began the year on San Miguel Island, but flew to Santa Rosa Island and on to Santa Cruz Island on 4 January. It stayed on Santa Cruz Island until 12 January, at which time it flew to Anacapa Island. It repeatedly flew between Anacapa and Santa Cruz Islands (15 times) until August, usually spending less that 3 weeks on each island. On 30 August it flew to Santa Rosa Island, where it stayed until 22 November. It spent 22-28 November on Santa Cruz Island, flew to Anacapa Island on 28 November, and then returned to Santa Cruz Island on 3 December, where it remained through the end of the year (Fig. 32).

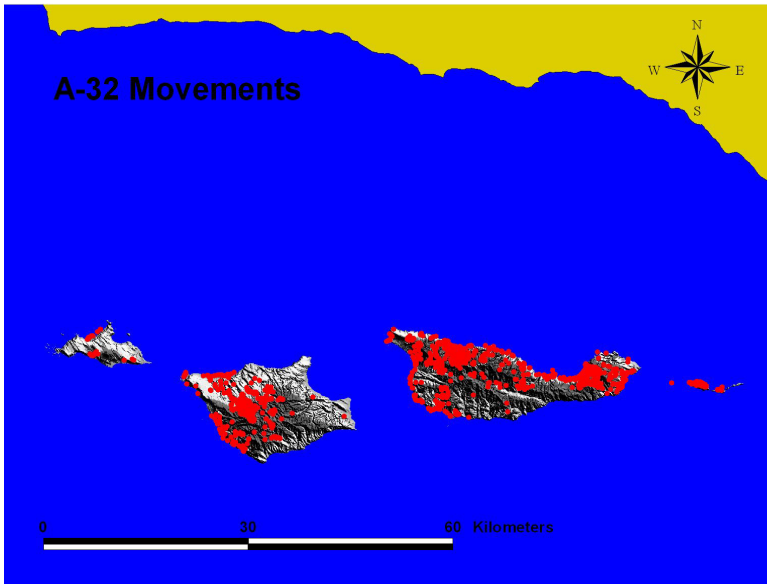

Figure 32. Locations of Bald Eagle A-32 on the northern Channel Islands, California in 2005.

A-33 Movements

Eagle A-33 remained on Santa Cruz Island throughout 2005, except for two days spent on Anacapa Island from 5-7 June (Fig. 33).

Additional Birds

There continue to be sightings of bald eagles on the islands that were not released as part of this project. Juvenile birds, likely from a central California population, have been seen feeding at pig carcasses with released eagles (Fig. 34) and there are at least three eagles from Santa Catalina Island currently on Santa Cruz Island (Fig. 35).

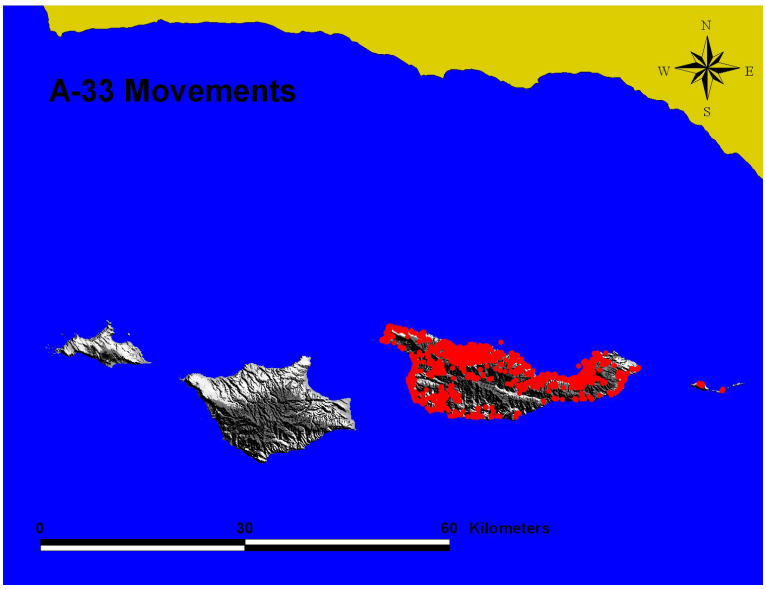

Figure 33. Locations of Bald Eagle A-33 on the northern Channel Islands, California in 2005.

Bald eagle K-10 (male) was fostered into the Twin Rocks nest on Santa Catalina Island in 2001 and K-26 (female) was fostered into the West End nest in 2002. These eagles were seen together frequently, mostly in the Prisoner's Harbor area, and are believed to have formed a pair. Bald eagle K-11 (male), fostered into the West End nest on Santa Catalina Island in 2001, has been seen several times in the vicinity of A-04 on the southwestern portion of Santa Cruz Island and they may also be a pair. Both pairs will be monitored in the 2006 season for evidence of breeding.

Figure 34. An unmarked juvenile bald eagle feeding with a tagged eagle on Santa Cruz Island, California on 7 August.

Overall Island Use

The GPS transmitters are the most effective way to monitor the released birds. During 2005, we received 26,243 GPS locations from the 12 eagles we released in 2005 and an additional 31,004 locations from 14 eagles released in previous years that are still carrying functioning transmitters.

Figure 35. Bald Eagles K-10 and K-26 feeding at a carcass on Santa Cruz Island on 7 September. Both birds were originally fostered into nests on Santa Catalina Island, California.

All four of the northern Channel Islands were used by released bald eagles in 2005. The eagles spent more time on Santa Rosa Island than any other island from January – March and October – December, and more time on Santa Cruz Island from April - September (Fig. 36). Data for January through June are from eagles released in 2002 – 2004. We released all of this season's eagles in July, which accounted for the increased number of birds for which we collected data (Fig. 36).

Foraging Activity

During monitoring activities we recorded 213 incidences of foraging by the eagles. Most of the observed foraging was upon pig carcasses (179 obs., 84%). Many of these observations were recorded with Cuddeback digital trail cameras placed by carcasses (Fig. 37).

Pig carcasses were provided for eagles primarily from June through December, although we did not put out as many carcasses as in previous years because of the high number of carcasses made available during pig eradication efforts. We did place pig carcasses in front of the hack towers a day or two prior to releasing the birds to attract ravens and allow the eagles

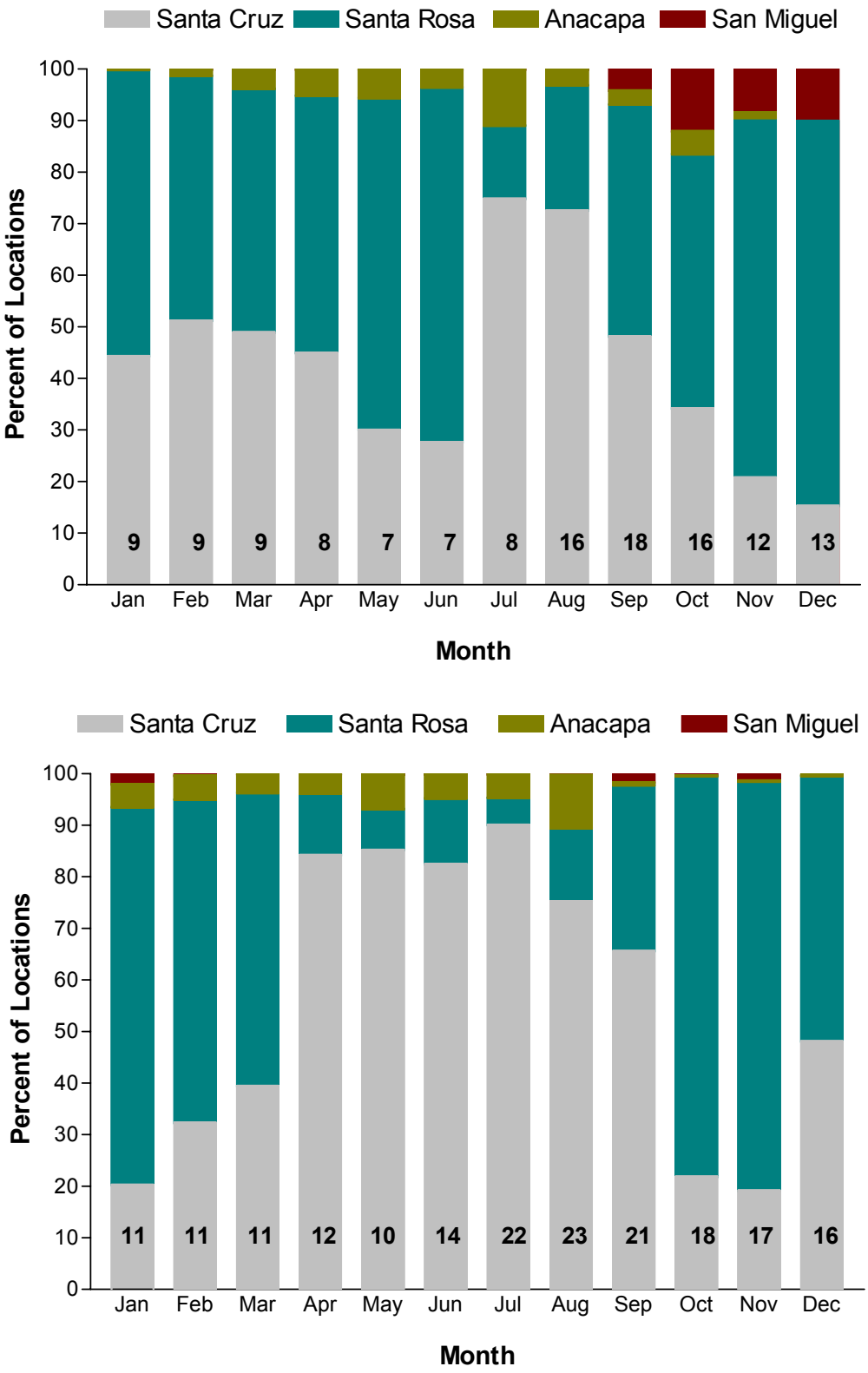

Figure 36. Use of the northern Channel Islands, California by bald eagles in 2004 (upper) and 2005 (lower). The bars represent the mean percent of time spent on each island as determined by GPS data. The number on each bar is the number of birds for which we received GPS data during each month.

to observe foraging activity. For the first two to four weeks post-release, we continued placing pig carcasses near the hack towers. Once the birds started moving around the island, carcasses were placed in various locations in the vicinity of the towers and in areas visited regularly by the eagles.

Figure 37. Bald Eagles A-36 and A-40 feeding on pig carcasses provided by IWS staff on Santa Cruz Island, California in 2005.

We had 26 observations of at least 12 individual bald eagles feeding upon or perched near nine marine mammal carcasses, primarily in the Chinese Harbor area (Table 3).

In 2005 there were several observations of bald eagles fishing. Catalina eagle K-10 was seen fishing on 18 March, 26 April and 27 May, and A-04 was seen fishing on 27 November.

Beach Watch Surveys

We conducted monthly surveys on seven beaches in 2005 and located a variety of potential food sources for bald eagles. The majority of carcasses were found on beaches at Chinese Harbor and Christy's Beach (Table 4).

Marine mammals are a potential source of large amounts of DDE contamination in the Southern California Bight. A total of 52 marine mammal carcasses were observed on beaches in 2005, either during beach watch surveys (43 carcasses, Table 4) or during field observations (9 carcasses; Table 3). Most of the carcasses (38) were California sea lions (*Zalophus californianus*). GPS and VHF data confirm eagle activity at many of these carcasses.

Table 3. Observations of bald eagles feeding on or perched near marine mammal carcasses on Santa Cruz Island, California in 2005.

Prey Species/Location	Date	Eagles Present
California Sea Lion (*Zalophus californianus*)		
Canada del Agua	8/4/05	A-39
Unidentified Marine Mammal		
Christy's Beach	7/21/05	A-16, A-27, A-28, A-34, A-37, A-39
Chinese Harbor	7/23/05	A-40, A-41, A-43, A-44, A-45,
Chinese Harbor	7/24/05	A-41
Chinese Harbor	7/27/05	A-?, K-?
Chinese Harbor	7/28/05	A-43, A-44, A-45
Chinese Harbor	7/29/05	A-34, A-37, A-40, A-41, A-44, A-45
Chinese Harbor	8/25/05	A-41
Potato Harbor	10/1/05	A-41

Trapping

Eagle A-02 was trapped on 7 April and A-04 was trapped on 12 August. Approximately 82 hours were spent trapping over 12 separate days. A-02 was trapped by the golden eagle crew and worked up by J. Dooley. Blood and feather samples were collected for stable isotope and contaminants analyses (Appendix III) and new GPS/VHF transmitters were attached.

Tissue Sampling

We collected blood and feather samples from bald eagles during banding activities when the eagles were approximately 11.5 weeks old (12 eagles) and during trapping activities when the eagles were >1 year old (3 eagles, Appendix III). We also collected samples from a variety of species to be used for DDT/PCB and stable isotope analyses (Appendix III).

Table 4. Carcasses found during surveys of seven beaches on Santa Cruz Island, California in 2004. Each beach was surveyed once per month.

Prey Item	Beach Surveyed[1]						
	CH	JB	PB	SB	CB	PH	LB
BIRD							
Black-vented shearwater ()	.	1	.	.	.	.	.
Northern fulmar (*Fulmarus glacialis*)	.	.	.	1	.	.	.
Brown pelican (*Pelecanus occidentalis*)	2	.	.	.	.	1	.
Brandt's cormorant (*Phalacrocorax penicillatus*)	1	.	.	.	.	.	.
Pelagic cormorant (*Phalacrocorax pelagicus*)	.	.			1	1	1
Western gull (*Larus occidentalis*)	.	.	.	1	.	.	1
Heermann's gull (*Larus heermanni*)	.	.	.	.	.	1	.
Surf scoter (*Melanitta perspicillata*)	.	.	.	.	.	1	.
Common loon (*Gavia immer)*	.	1	.	.	.	.	.
Eared grebe (*Podiceps nigricollis)*	.	.	.	.	1	.	.
Unidentified bird	2	.	.	.	.	.	.
FISH							
Unidentified fish	.	1	.	1	.		.
INVERTEBRATES							
Purple stripe jellyfish (*Chrysaora colorate*)	.	.	1	.	.	.	.
Sheep crab (*Loxorhynchus grandis*)	.	.	.	.	.	1	.
Starfish (*Pisaster spp.*)	.	.	.	.	.	.	1
MAMMAL							
California sea lion (*Zalophus californianus*)	18	2	1	4	8	4	.
Harbor seal (*Phoca vitulina)*	2	.	.	.	2	.	.
Unidentified pinniped	1	.	.	.	.	.	.
Unidentified cetacean	.	.	.	.	1	.	.
TOTAL ITEMS	**26**	**5**	**2**	**7**	**13**	**9**	**3**

[1] CH = Chinese Harbor, JB = Johnson's Beach, PB = Pozo Beach, SB = Sauces Beach, CB = Christy Beach, PH = Prisoner's Harbor, LB = Laguna Beach

DISCUSSION

The bald eagle restoration project on the northern Channel Islands has been successful at establishing bald eagles on the islands during the first four seasons of the five-year project. To date we have released 46 eagles on the island (24 from Alaska, 21 from the Zoo, 1 from California), of which at least 31 are still on the islands and two are on the mainland. There are fifteen birds known or assumed to be dead: five from the Zoo and nine from Alaska, and one from a northern California rehabilitation center.

Since the inception of this bald eagle restoration study, minimum first-year survival has been higher than we had expected, averaging 77% (67%, 90%, 67%, and 83% in 2002-2005, respectively). This survival rate, which assumes birds of unknown status are dead, is similar to first-year survival reported for bald eagles in Florida (63%, Wood 1992; 77%, Millsap et al. 2004), Alaska (71%, Bowman et al. 1995), northern California (77%, Jenkins et al. 1999), and Santa Catalina Island (70-75%, unpublished data), but slightly lower than that found in the Greater Yellowstone Ecosystem (86.7%, Harmata et al. 1999). Second-year survival has averaged 89% for eagles released on Santa Cruz in 2002 (100%), 2003 (89%), and 2004 (78%), which is slightly higher than the second-year survival reported for eagles in Florida (86%, Millsap et al. 2004) and the Yellowstone region (85%, Harmata et al. 1999). Third year survival for 2002 birds was 88%, the same as reported by Millsap et al. (2004), and fourth year survival is believed to be 100%. Birds released in 2003 had a lower third year survival rate of only 67%.

The increased use of Santa Cruz Island by bald eagles in April corresponded to the start of pig eradication efforts on the island. Throughout the summer there were many carcasses available upon which eagles could scavenge. The movement of eagles back to Santa Rosa Island seems to correspond with the start of fall hunting on that island, where we believe mule deer (*Odocoileus hemionus*) and Roosevelt elk (*Cervus canadensis*) carcasses and/or gut piles become readily available. This use of Santa Rosa Island in the fall continues to concern us because of the continued use of lead ammunition during the hunt. With the first confirmed case of lead poisoning in a bald eagle on Santa Rosa Island in December and the two other mysterious deaths of eagles on Santa Rosa Island in October 2004 (A-14) and September 2005 (A-18), lead poisoning is a threat to bald eagle survival that should be addressed.

The success of this restoration project ultimately will be determined by the ability of the eagles to breed and form a self-sustaining population. Bald eagles generally breed at about 4-6 years of age, but may breed as young as 3-4 years of age (Mulhern et al. 1994). The oldest birds from our Santa Cruz releases will be four years old in spring 2006 and K-10 and K-11 from Catalina will be five years old. During 2005, we have begun to see evidence of territory formation by some of the older birds (i.e., A-02, A-04) based upon our GPS and VHF telemetry data. Eagle K-10 and K-26 have been seen repeatedly in close proximity to each other.

SUGGESTIONS FOR ACTIVITIES IN 2006

Because breeding activity could start in 2006, we suggest conducting island-wide surveys in late-winter/early spring to look for potential nest sites, especially on Santa Cruz and Santa Rosa Islands. If nests are found, it would be prudent to have a plan of action in place that includes adding additional seasonal staff members and purchasing video surveillance equipment to monitor nests to determine the outcome of any breeding activity.

We have conducted the beach watch surveys for the past three seasons. During that time we have collected ample data on the types and abundance of prey that can be found on Santa Cruz Island and the beaches where these items are most commonly found. We do not believe that it is necessary to continue the beach watch surveys in 2006. Personnel time can be more effectively used monitoring the existing eagles on the islands, searching for eagle breeding activity, and providing food for the 2006 hack tower birds, which may be more time consuming as the pig population declines. However, during telemetry tracking and other field efforts we would still record occurrences of eagles feeding on beached organisms.

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APPENDIX I. BEACH WATCH SURVEY FORM

Beach Monitoring Survey Form

BEACH _____ DATE
SURVEYORS
Time begin _____ time end _____ approx. tide ht. _____ Percent of total
Wind _____ general weather_____ beach surveyed
Beached Organisms

Species	Condition	Sex	Age	Previous	Post	Scavenged	Cause of Death	Oiled	Oil Extent	Where Oiled	Photo	Comments

Codes for Beached Organisms Categories
Condition: 1 (live dying), 2 (fresh dead), 3 (decomposing), 4 (dried, mumified), U (unknown).
Sex: F(female), M (male), U (unknown).
Age: HY (hatch year), AHY (after hatch year), FY (first year), SY (second year), TY (third year), IM (immature), AD (adult), PC (pup, newly hatched chick/egg, or calf) U (unknown).
Toe Clipping: Indicate number of toes clipped when you encountered animal (previous), and number clipped when you left it (post). Leave blank if no toes to clip. Indicate "6" if all toes have been clipped on bird with two feet. Indicate "8" if all toes have been clipped on bird with one foot. Indicate "9" if animal is removed from beach. Use comments if necessary.
Scavenged: Y (yes), N (no), U (unknown).
Probable Causes of Death: 1 (shot), 2 (tangled in fishing net/line), 3 (tangled in plastic), 4 (unknown), if other write in.
Oiled: Y (yes), N (no), U (unknown).
Oil Extent: 1 (small globules, <2% of body), 2 (2-33% of body), 3 (34-66% of body), 4 (67-100% of body).
Where Oiled: 1 (dorsal only), 2 (ventral only), 3 (entire body), 4 (head only), 5 (feet only), 6 (wings/flippersonly), 7 (other).
Photo: Y (yes), N (no).
Tag: Y (yes), N (no).
Comments: Indicate number, color, and location of any tags present. Disposition and label of removed animal. Length measurements. Photo roll and frame numbers.

Beach Monitoring Survey Form

BEACH _____ DATE

Human activity (note dogs on beach also)

number	Activity Code	Comments

Human Activity Codes for Beach Monitoring Survey Form

1-Research, 2-Tidepooling/exploring, 3-Walking, 4-Exercising dog (or other type of pet: note in comments), 5-Sunbathing, 6-Fishing (including clamming or other extractive activity: note specific type in comments), 7-Kayaking, 8-Kite flying, 9-Other

Live Animal Count (shorebirds/marine mammals etc)

# oiled	Total	Tally(count)	Species	Comments

Band and tag information for live animals. Species, color, location, number, tag type

Tar balls/pancakes (number, size/type, fresh/weathered)

Main debris types and approx. quantities

Notes (presence of *Arundo donax*, disturbance to archeological sites, pig activity, etc.):

APPENDIX II. SANTA CRUZ ISLAND SAMPLING PROTOCOL

INTRODUCTION

The Montrose Settlements Restoration Program (MSRP) is completing a Bald Eagle Feasibility Study to investigate the likelihood of successful bald eagle reintroduction on the northern Channel Islands. Bald eagle chicks are being released by the Institute for Wildlife Studies (IWS) on Santa Cruz Island and information is being gathered to help determine what degree of human manipulation, if any, will be required for the bald eagles to successfully breed there. Monitoring, sample collection, and analysis of samples for both contaminants (total DDTs and PCBs) and for stable isotopes (carbon, nitrogen, and sulfur isotopes) are being used to aid in this determination.

The results of the DDT and PCB analyses of bald eagle blood, and tissues (primarily muscle and adipose except for fish) of marine fish, marine mammals, and feral pigs will be used to determine the bald eagle exposure through their diet and predict the likelihood of successful reproduction. The Woods Hole Group will complete the sample preparation and DDT/PCB analyses under an agreement with the National Oceanic and Atmospheric Administration.

Stable isotope analysis is a well-established technique that can provide dietary information for different time scales based on a single collection event, with less expense and time than techniques such as monitoring prey delivery to the nest. Samples of bald eagle blood and feathers, prey species, and other species needed to characterize the food web will be collected and analyzed. The isotope laboratory at Northern Arizona University will complete the sample processing and the stable isotope analysis under an agreement with the Fish and Wildlife Service. Currently, carbon and nitrogen analyses will be done for blood samples, and carbon, nitrogen, and sulfur analysis for tissue, feather, and egg samples. The stable isotope results for bald eagle blood and feather samples will be related to trophic level and marine versus terrestrial diet, and the inferences regarding diet will be verified based on telemetry and feeding data collected.

SAMPLE IDENTIFICATION SYSTEM

Samples will be identified with a 12 letter/number code. Two numbers for the year (02 for 2002) followed by the first letter that represents the Principal Investigator (G, for Garcelon in this case), followed by a two letter site designation, a two letter species designation, two numbers for the individual, a one letter identification of the tissue type, and a two number sample ID (see below for codes). So for instance, the sample 02GNTBE03D01 would be collected in 2002 (02) by/for Garcelon (G) at the North hacktower (NT) and would be bald eagle (BE) number 3 (03) blood (D) sample number 1 (01).

Codes

Year:
- 2002 (02)
- 2003 (03)

Principal Investigator:
- Garcelon (G)

Locations:
- Christy's Beach (CB)
- Chinese Harbor (CH)
- Fox Pen Area (FP)
- Johnston's Beach (JB)
- Laguna Beach (LB)
- No Man's Land (NL)
- North Hacktower (NT)
- Prisoner's Beach (PB)
- Pozo Beach (PZ)
- Sauces Beach (SB)
- South Hacktower (ST)
- Field Blank (XX)

Other codes can be added as needed if samples are collected from other areas and the code system should be revised to include them, but the following Catalina codes of WE, TR, PR, SR or TH should not be used.

Species:
- Bald Eagle (BE)
- California Gull (CG)
- Harbor Seal (SE)
- Sea Lion (SL)
- Feral Pig (SS)

Add species names as needed for other fish, seabird, and marine mammal species and revise the code system to include them.

Individual:

Sequentially number individuals within a species with a unique number, rather than starting over each year.

Tissue:
- Muscle (M)
- Adipose (A)
- Whole Body or Whole Gutted Body (B)
- Blood (D)
- Feather (F)
- Field Blank (N)

Sample Number:

Number sequentially for each species/tissue type (eg. 02GNTBE01D01, 03GSTBE04D02, 02GCHSL02M01, 03GPZSL05A01).

FIELD COLLECTION RECORDS

The following information should be recorded in a field notebook: date, time, location and GPS coordinates, individuals involved in sampling, species, tissue collected and location of the body from which it was removed, amount collected, and sample container used. Photographs should be taken of the individual sampled and the location on the body from which tissue samples are removed, and the photographs taken noted in the field log. Record for each sample collected whether it was collected for DDT/PCB analysis, stable isotope analysis, or both.

FIELD TECHNIQUES FOR COLLECTING SAMPLES

When collecting samples that require removing tissues in the field, please use the following guidelines to avoid contamination/cross-contamination of the samples.

Use certified chemically clean glass containers (e.g. I-Chem). Containers should be kept capped prior to sample collection. Handling of containers should be kept to a minimum and the inside of the container should not be touched by anything other than the sample.

Clean non-powdered nitrile gloves (vinyl gloves contain phthlates that may interfere with contaminant analysis) should be worn by all sampling personnel. Sampling gloves should be changed in between external examination and cutting (i.e., a new pair of gloves should be worn after opening the body cavity and before sampling internal tissues).

Clean gloves and sampling equipment should not come in contact with any surface (e.g., the ground, necropsy kit, etc.). New scalpel blades should be used for the collection of each tissue sample.

Cross-contamination between tissues should be avoided. This is particularly important after blubber tissue has been handled for chlorinated hydrocarbon sampling. The scalpel and forceps should be cleaned after taking each sample. All tissue surfaces that come into contact with implements that were not cleaned (e.g., blubber when the body was opened) should be cut away with clean implements. The sample should not come into contact with the outside of the sampling container or the ground.

For marine mammals, remove blubber sample from the sternum region with a knife or with a scalpel and forceps. The sample should not come into contact with the outside of the sampling container or the ground.

Label the sampling container, place the sample in a cooler on ice, note sampling location and time, animal ID number, species, tissue (duplicate samples should be numbered sequentially), date collected, collection site. Labels should be written with waterproof ink and securely attached to the outside of each sample container.

CLEANING SAMPLING EQUIPMENT

In the field, clean equipment between each sample with soapy (Alconox) tap water, rinse with tap water, rinse with distilled water, rinse with pesticide grade isopropanol, air dry, and store equipment wrapped in aluminum foil. At the end of the sampling for that day, chemically clean filter paper (Whatman 934-AH, approximate diameter of 6 cm) should be used to wipe the cleaned equipment and then placed in a vial of the same type and batch used for samples, labeled as a field blank, and stored and transported similarly to the tissue samples. A "blank unused filter" should be saved from each box, the box labeled with date opened, and the filter saved in a jar with the date of the box opened.

After returning from the field, sampling equipment should be washed with hot, soapy (Alconox) water, rinsed with hot tap water, rinsed with 10-15% nitric acid (use protective clothing, gloves, and goggles), rinsed with distilled water, rinsed with pesticide grade isopropanol, air dried, and wrapped in aluminum foil.

ITEMS TO BE SAMPLED

General Information on Field Duplicates and Field Blanks

For stable isotope analysis, no field blanks are necessary because interference and cross-contamination are not a problem. In addition, no field duplicates are required, but sufficient tissue (2 g) will be collected for each sample so the original and a lab duplicate can be run from the field sample. For isotope analysis, field variability is considered by sampling separate individuals of the same species. This intra-specific variability will provide a sense of how isotope signatures vary from one individual to another.

For DDT/PCB analysis, both field duplicates and field blanks will be collected. One field duplicate per 15 samples or per sampling season will be collected unless otherwise noted for a particular sample type. If equipment is not used for more than one sample, one field blank of each sample type per 15 samples or per sampling season will be collected. If equipment is re-used, then a field blank will be collected (after equipment cleaning) at the end of each sampling day to assess potential cross-contamination between samples. Clean filter paper, wetted with isopropanol, will be used to wipe the cleaned equipment. The filter paper will be placed in a pre-cleaned sample jar or aluminum foil and plastic bag of the same type and batch used for samples, labeled with the date, time, and sample collector. One sample of unused filter paper per batch will also be saved. The field blanks will be stored and transported along with the samples

collected for DDT/PCB analysis.

Bald Eagle

Blood (DDT/PCB and stable isotope):

Collect whole blood and plasma samples for stable isotope and DDT/PCB analyses from all bald eagles when banded prior to release (12 birds per year) and from any birds re-captured. Label all containers (pre-cleaned glass vials) prior to blood collection using the labeling protocol above. Collect 10 cc of blood during banding or re-capture. Put 2 cc whole blood in a 20 ml vial for DDT/PCB analysis (unless making a duplicate, see below) and approximately 0.1 cc whole blood in another glass vial for stable isotope analyses. Store the samples on ice immediately after collection. Heparin coated vacutainers will be used since it does not cause interference in stable isotope analysis, whereas EDTA may interfere and should not be used as an anti-coagulant.

As soon as possible following collection, spin the remaining blood to get the plasma. Transfer at least 2 cc of plasma into a 20 mL glass vial for DDT/PCB analyses and at least 0.1 cc of plasma into another glass vial for stable isotope analysis. Label the test tube containing the red blood cells (leftover from spinning off the plasma) with the bird=s ID and date collected. The blood cells will be kept in the freezer for possible future use. Freeze all the other blood samples as soon as possible.

One field duplicate (2 cc) per 15 samples or per sampling season, whichever is more frequent, should be collected for both whole blood and plasma. Therefore, collect one duplicate each for whole blood and plasma during the blood collection from chicks during banding. For re-captured birds, collect one duplicate each whole blood and plasma per season or per 15 samples will be taken during blood collection from re-captured birds. Whole blood and plasma duplicates can be from different birds. Select one bird=s sample that has appropriate amounts of plasma to make vials containing 2 cc of plasma (for DDT/PCB analysis). Give the duplicate samples sequential sample numbers.

Quality control for blood collection for the DDT/PCB analysis should address potential interference and cross-contamination. Since no needles or containers are re-used, cross-contamination due to re-use of equipment should not be an issue. However, plastic syringes may leach interfering substances that should be accounted for. Therefore, one field blank per batch of syringes or per sampling season, whichever is sooner, should be included. For the field blank, distilled water should be drawn up into the syringe, transferred to the container as with blood samples, and stored and transported with the blood sample containers.

Feathers (stable isotope only):

For stable isotope analysis, collect three breast feathers from each bird and store in an envelope (one envelope per bird). Collect feathers from the same area on the breast for all birds, and note the location as closely as possible by diagram and photograph (if available). Collect feathers of same coloration and those that appear of same relative age since the yearly molt is incomplete and some feathers may be retained for 2 to 3 years (McCollough, 1989).

Feral Pig

Muscle and Adipose Tissues (DDT/PCB and stable isotopes):

Tissues will be collected for both stable isotopes (muscle and adipose tissue from five pigs) and DDT/PCB (muscle and adipose tissues from three of the five pigs sampled). Collect muscle and adipose tissues from the leg of five pigs of varying sizes, and record and photograph the location from which the tissue was removed (e.g. upper thigh muscle on front right leg). Remove any associated non-target tissue. Estimate sample mass by placing the vial in a bag and weighing it with the Pesola scale. Collect samples (2 g muscle tissue in a 20 mL glass vial and 20 g adipose tissue in a 60 mL glass vial) for stable isotopes only from two pigs. For three of the five pigs, split the muscle tissue sample into two jars, a 20 mL glass vial with approximately 2 g for stable isotope analysis and a 60 mL glass vial with approximately 50 g for DDT/PCB analyses. For adipose tissue from three of five pigs, place approximately 20 g into one 60 mL glass vial for stable isotopes and 50 g into another 60 mL glass vial for DDT/PCB analyses. In addition,

For DDT/PCB analysis, collect one duplicate of both muscle (50 g) and adipose tissue (50 g) and one field blank per sample day (filter paper swipes of re-used equipment in 20 mL or 60 mL glass container).

Marine Fish

Record standard (whole body excluding the tail) and total length, weight, and species for each fish collected. Total length is defined as the length from the most anterior part of the fish to the tip of the longest caudal fin ray. (Exhibit 2 demonstrates the different fish measurements.) Standard length is defined as the length of a fish from the front of the upper lip to the posterior end of the vertebral column.

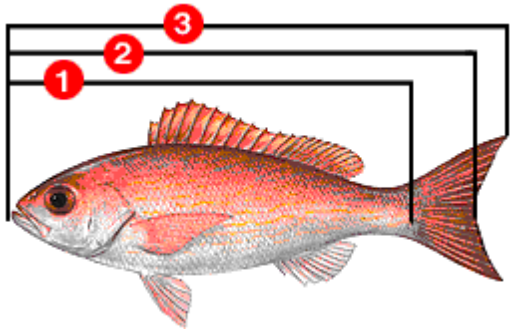
Exhibit 2. Description of Different Length Measurements

(1) Standard Length
(2) Fork Length
(3) Total Length

Whole Gutted Fish (DDT/PCB and stable isotopes):

Whole fish will be collected and then gutted before freezing to reduce variability due to incomplete assimilation of gut contents.

For DDT/PCB analysis, collect whole fish of 5 different species (5 individuals each) representative of those the eagles are eating or are caught to feed eagles in the hack towers (25 total samples). The entire fish should be gutted, wrapped in aluminum foil, placed in a plastic bag, and frozen. Collect one field duplicate (50 g) per every 15 samples or per sampling season, whichever is sooner for DDT/PCB analyses and make one field blank per sampling day (filter paper swipe of cleaned equipment).



If possible, the fish collected for DDT/PCB analysis will be subsequently analyzed for stable isotopes as well; however, additional fish samples for stable isotopes are necessary to characterize the food web structure.

For stable isotopes, collect five samples per species with at least one species from each functional feeding group: pelagic/epipelagic (e.g. anchovy, topsmelt, barracuda, mackeral), mid-water (e.g. kelp bass, surfperch), benthic (e.g. gobies, sculpin), and demersal (e.g. rockfish). The entire fish should be gutted, wrapped in aluminum foil, placed in a plastic bag, and frozen.

Marine Mammals

Collect muscle and adipose tissues from the same body part as consistently as possible and note the location from which the tissue was removed, with a photograph if possible. Remove any associated tissue and obtain a sample with only the tissue type desired. Separate tissue collected from same organism into samples for stable isotope and DDT/PCB as possible to allow for direct comparison of tissue concentrations and stable isotope profiles.

Muscle and Adipose Tissue (DDT/PCB and stable isotopes):

For stable isotope analyses, collect five samples of muscle tissue (2 g) and five samples of adipose tissue (20 g) from the same organisms sampled for DDT/PCB analysis. Place in the smallest vials in which they will fit. Freeze samples.

For DDT/PCB analyses, collect 15 samples of muscle (50 g) and 15 samples of adipose tissue (50 g). Again, place in smallest vial in which they will fit. Collect one duplicate sample each of muscle (50 g) and adipose tissue (50 g) per 15 samples or per sampling season, whichever is more frequent. Collect one field blank per sampling day by using filter paper to wipe cleaned equipment at the end of each sampling day. Freeze all samples as soon as possible.

Macro-invertebrates (stable isotopes only)

For stable isotope analysis, collect five composite samples each for squid (5 individuals), euphasiids (fill 20 mL vial using plankton net), snails (15 individuals with shells removed), mussels (5 individuals, soft body only), and shrimp (10 individuals) (25 composite samples total). Place samples in pre-cleaned glass vials, store samples on ice until frozen, and freeze samples as soon as possible.

Sea Birds

Breast Muscle (stable isotopes only):

For stable isotope analyses, collect 15 samples of breast muscle (2 g) from relatively fresh sea bird carcasses remove any associated non-muscle tissue, and place in 20 mL vials. Note and photograph the quadrant of the breast muscle area (e.g. upper right) from which the tissue was removed. Keep samples on ice and freeze them as soon as possible.

Feathers (stable isotopes only):

Collect three closely located breast feathers from each bird, note the location on the breast from which they were removed, and place in one envelope per bird.

SAMPLE STORAGE

Manually check the freezer temperature before storing samples and 5 days a week or check weekly with a freezer temperature recorder to ensure the samples are maintained at -20 EC.

SAMPLE SHIPPING

Samples should be shipped in batches to the appropriate analytical laboratory or the Fish and Wildlife Service Office based on information provided by the Fish and Wildlife Service contact (Beckye Stanton and/or Annie Little). Samples should be placed in a cooler with foam packing material and a chain of custody form. Samples should be transported frozen with ice packs on the ferry and then with additional ice packs if hand delivered or with sufficient dry ice if shipped.

LITERATURE CITED

McCollough, M. A. (1989) Molting sequence and aging of bald eagles. *The Wilson Bulletin* **101**, 1-10.

APPENDIX III. Tissue samples collected for contaminant and stable isotope analyses, Santa Cruz Island, California, 2004.

Sample ID[1]	Description	Analysis	Species	BAEA ID	Date
05GCBEG01M01	2 g Muscle	Stable Isotope	Eared Grebe		3/13/2005
05GCBEG01F01	3 Breast Feathers	Stable Isotope	Eared Grebe		3/13/2005
05GCHSL09A01	50 g Adipose tissue	DDT/PCB	California Sea Lion		1/15/2005
05GCHSL09M01	50 g Muscle	DDT/PCB	California Sea Lion		1/15/2005
05GJBCL01M01	2 g Muscle	Stable Isotope	Common Loon		1/17/2005
05GJBCL01F01	Feathers	Stable Isotope	Common Loon		1/17/2005
05GCHSL10A01	50 g Adipose tissue	DDT/PCB	California Sea Lion		2/9/2005
05GCHSL10M01	50 g Muscle	DDT/PCB	California Sea Lion		2/9/2005
05GCHBC03M01	2 g Muscle	Stable Isotope	Brandt's Cormorant		4/6/2005
05GCHBC03F01	Feathers	Stable Isotope	Brandt's Cormorant		4/6/2005
05GMDBE03F02	Breast Feathers	Stable Isotope	Bald Eagle	629-02798	4/7/2005
05GMDBE03D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-02798	4/7/2005
05GMDBE03D02	0.2 ml Whole Blood	Stable Isotope	Bald Eagle	629-02798	4/7/2005
05GMDBE03D03	2 ml Plasma	DDT/PCB	Bald Eagle	629-02798	4/7/2005
05GMDBE03D04	0.2 ml Plasma	Stable Isotope	Bald Eagle	629-02798	4/7/2005
05GSBWG03M01	2 g Muscle	Stable Isotope	Western Gull		4/21/2005
05GSBWG03F01	Breast Feathers	Stable Isotope	Western Gull		4/21/2005
05GPBPC01M01	2 g Muscle	Stable Isotope	Pelagic Cormorant		5/5/2005
05GPBPC01F01	Breast Feathers	Stable Isotope	Pelagic Cormorant		5/5/2005
05GPBSL11A01	50 g Adipose Tissue	DDT/PCB	Sea Lion		6/17/2005
05GPBSL11M01	50 g Muscle	DDT/PCB	Sea Lion		6/17/2005
05GSTBE39D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47388	6/29/2005
05GSTBE39D02	0.1 ml Whole Blood	Stable Isotope	Bald Eagle	629-47388	6/29/2005
05GSTBE39D03	3 ml Plasma	DDT/PCB	Bald Eagle	629-47388	6/29/2005
05GSTBE39D04	0.5 ml Plasma	Stable Isotope	Bald Eagle	629-47388	6/29/2005
05GSTBE39F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-47388	6/29/2005
05GSTBE40D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47389	6/29/2005
05GSTBE40D02	0.1 ml Whole Blood	Stable Isotope	Bald Eagle	629-47389	6/29/2005
05GSTBE40D03	2 ml Plasma	DDT/PCB	Bald Eagle	629-47389	6/29/2005
05GSTBE40D04	2 ml Plasma	DDT/PCB	Bald Eagle	629-47389	6/29/2005
05GSTBE40D05	0.5 ml Plasma	Stable Isotope	Bald Eagle	629-47389	6/29/2005
05GSTBE40F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-47389	6/29/2005
05GSTBE41D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47390	6/29/2005
05GSTBE41D02	0.1 ml Whole Blood	Stable Isotope	Bald Eagle	629-47390	6/29/2005
05GSTBE41D03	2.5 ml Plasma	DDT/PCB	Bald Eagle	629-47390	6/29/2005
05GSTBE41D04	0.5 ml Plasma	Stable Isotope	Bald Eagle	629-47390	6/29/2005

Appendix III. Continued

Sample ID	Description	Analysis	Species	BAEA ID	Date
05GSTBE42D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47391	6/29/2005
05GSTBE42D02	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47391	6/29/2005
05GSTBE42D03	0.1 ml Whole Blood	Stable Isotope	Bald Eagle	629-47391	6/29/2005
05GSTBE42D04	2.5 ml Plasma	DDT/PCB	Bald Eagle	629-47391	6/29/2005
05GSTBE42D05	0.5 ml Plasma	Stable Isotope	Bald Eagle	629-47391	6/29/2005
05GSTBE42F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-47391	6/29/2005
05GSTBE36D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47385	6/30/2005
05GSTBE36D02	0.5 ml Whole Blood	Stable Isotope	Bald Eagle	629-47385	6/30/2005
05GSTBE36D03	2 ml Plasma	DDT/PCB	Bald Eagle	629-47385	6/30/2005
05GSTBE36D04	0.5 ml Plasma	Stable Isotope	Bald Eagle	629-47385	6/30/2005
05GSTBE36F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-47385	6/30/2005
05GSTBE37D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47386	6/30/2005
05GSTBE37D02	0.5 ml Whole Blood	Stable Isotope	Bald Eagle	629-47386	6/30/2005
05GSTBE37D03	2 ml Plasma	DDT/PCB	Bald Eagle	629-47386	6/30/2005
05GSTBE37D04	0.5 ml Plasma	Stable Isotope	Bald Eagle	629-47386	6/30/2005
05GSTBE37F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-47386	6/30/2005
05GSTBE38D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47387	6/30/2005
05GSTBE38D02	0.5 ml Whole Blood	Stable Isotope	Bald Eagle	629-47387	6/30/2005
05GSTBE38D03	3 ml Plasma	DDT/PCB	Bald Eagle	629-47387	6/30/2005
05GSTBE38D04	0.5 ml Plasma	Stable Isotope	Bald Eagle	629-47387	6/30/2005
05GSTBE38F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-47387	6/30/2005
05GNTBE43D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47392	7/6/2005
05GNTBE43D02	0.5 ml Whole Blood	Stable Isotope	Bald Eagle	629-47392	7/6/2005
05GNTBE43D03	2.5 ml Plasma	DDT/PCB	Bald Eagle	629-47392	7/6/2005
05GNTBE43D04	0.5 ml Plasma	Stable Isotope	Bald Eagle	629-47392	7/6/2005
05GNTBE43F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-47392	7/6/2005
05GNTBE44D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47393	7/6/2005
05GNTBE44D02	0.5 ml Whole Blood	Stable Isotope	Bald Eagle	629-47393	7/6/2005
05GNTBE44D03	3 ml Plasma	DDT/PCB	Bald Eagle	629-47393	7/6/2005
05GNTBE44D04	0.5 ml Plasma	Stable Isotope	Bald Eagle	629-47393	7/6/2005
05GNTBE44F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-47393	7/6/2005
05GNTBE45D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47399	7/15/2005
05GNTBE45D02	0.5 ml Whole Blood	Stable Isotope	Bald Eagle	629-47399	7/15/2005
05GNTBE45D03	2 ml Plasma	DDT/PCB	Bald Eagle	629-47399	7/15/2005
05GNTBE45D04	0.2 ml Plasma	Stable Isotope	Bald Eagle	629-47399	7/15/2005
05GNTBE45F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-47399	7/15/2005

Appendix III. Continued

Sample ID	Description	Analaysis	Species	BAEA ID	Date
05GNTBE46D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-47400	7/15/2005
05GNTBE46D02	0.2 ml Whole Blood	Stable Isotope	Bald Eagle	629-47400	7/15/2005
05GNTBE46D04	0.5 ml Plasma	Stable Isotope	Bald Eagle	629-47400	7/15/2005
05GNTBE46F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-47400	7/15/2005
05GNTBE47D01	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-02800	7/15/2005
05GNTBE47D02	0.2 ml Whole Blood	Stable Isotope	Bald Eagle	629-02800	7/15/2005
05GNTBE47D03	2 ml Plasma	DDT/PCB	Bald Eagle	629-02800	7/15/2005
05GNTBE47D04	0.2 ml Plasma	Stable Isotope	Bald Eagle	629-02800	7/15/2005
05GNTBE47F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-02800	7/15/2005
05GNSPM10B01	Whole Gutted Fish	Stable Isotope	Pacific Mackerel		7/22/2005
05GNSKR04B01	Whole Gutted Fish	DDT/PCB	Kelp Rockfish		8/1/2005
05GNSKR05B01	Whole Gutted Fish	DDT/PCB	Kelp Rockfish		8/1/2005
05GNSMS01B01	Whole Squid	Stable Isotope	Squid		8/4/2005
05GNSMS02B01	Whole Squid	Stable Isotope	Squid		8/4/2005
05GNSMS03B01	Whole Squid	Stable Isotope	Squid		8/4/2005
05GNSMS04B01	Whole Squid	Stable Isotope	Squid		8/4/2005
05GNSMS05B01	Whole Squid	Stable Isotope	Squid		8/4/2005
05GCPBE05D03	2 ml Whole Blood	DDT/PCB	Bald Eagle	629-14042	8/12/2005
05GCPBE05D04	1 ml Whole Blood	Stable Isotope	Bald Eagle	629-14042	8/12/2005
05GCPBE05D05	2 ml Plasma	DDT/PCB	Bald Eagle	629-14042	8/12/2005
05GCPBE05D06	1 ml Plasma	Stable Isotope	Bald Eagle	629-14042	8/12/2005
05GCPBE05F01	3 Breast Feathers	Stable Isotope	Bald Eagle	629-14042	8/12/2005
05GNSEU01B01	120 ml Composite Sample	Stable Isotope			8/17/2005
05GNSEU02B01	120 ml Composite Sample	Stable Isotope			8/17/2005
05GNSEU03B01	120 ml Composite Sample	Stable Isotope			8/17/2005
05GNSEU04B01	120 ml Composite Sample	Stable Isotope			8/17/2005
05GNSEU05B01	120 ml Composite Sample	Stable Isotope			8/17/2005
05GPBSM01B01	1 Mussel, Shell Removed	Stable Isotope	Mussel		8/17/2005
05GPBSM02B01	1 Mussel, Shell Removed	Stable Isotope	Mussel		8/17/2005
05GPBSM03B01	1 Mussel, Shell Removed	Stable Isotope	Mussel		8/17/2005
05GPBSM04B01	1 Mussel, Shell Removed	Stable Isotope	Mussel		8/17/2005
05GPBSM05B01	1 Mussel, Shell Removed	Stable Isotope	Mussel		8/17/2005

[1] See Appendix II for description of Sample ID codes.